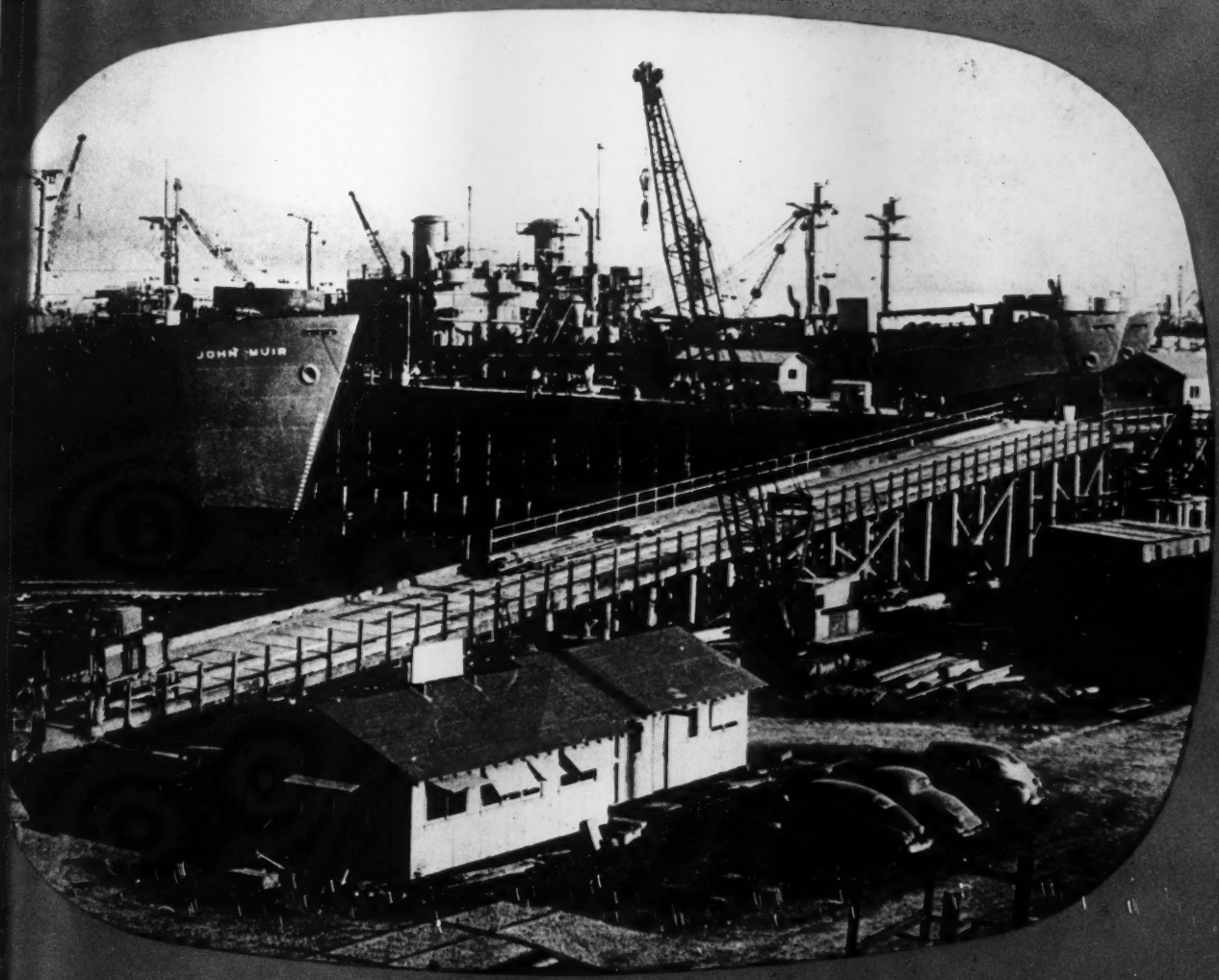
APR 13 1943

ENGINEERING NEWS-RECORD

APRIL 8, 1943



Deck-high outfitting dock with an access ramp expedites shipbuilding operations (see story inside).

Postwar Planning in New York • **Highway Exploration in Bolivia**

Dredging Hard Material in Rough Water

Wood Tanks for Sewage Treatment • **Continuous Beam Analysis**

"Lands like a Feather"...

...with a 60-TON JOLT

The heavily-laden plane that lands so smoothly can mean lots of trouble for underground pipe. Even in a perfect "sit down" the impact equals the full weight of the plane. On less-than-perfect landings this force may be doubled or tripled. Yet drainage systems constructed of ARMCO Corrugated Metal Pipe take the punishment without flinching.

Flexible ARMCO Pipe (plain or perforated) has proved ability to resist crushing, cracking or disjointing under the impact and weight of heavy loads. Th means freedom from failure even under shallow cov You have continued assurance of a firm, dry field wi uniform support for runways or direct wheel load Other advantages include long lengths; band couple to assure strong joints; and ease of installation wi unskilled labor.

Consider ARMCO Corrugated Metal Pipe when yo are planning or building essential wartime airport Ask your local ARMCO man to show you the Manu of Airport Drainage, or write us direct regardi specific problems. Write today to Armco Draina Products Association, 185 Curtis St., Middletown, Ohi

Installing 800 feet of 66-inch Corrugated ARMCO *Asbestos-Bonded Paved Pipe under runway at large bomber base.*

ARMCO

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CORRUGATED PIP

NGINEERING NEWS-RECORD

...ed to Buildings, Sewers, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Shipbuilding, Irrigation, Canals, Railroads

McGRAW-HILL PUBLISHING COMPANY, INC.

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JOHN ABBINK, *Publisher*

WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Manager*

...l. 130 APRIL 8, 1943 No. 14

...COMING NEXT

...Timber hangars for the Navy's ...mps are furnishing a fertile field ... the exercise of construction in...uity, each contractor attacking ... job in a different way. The first ... several articles describing these ...ious erection procedures is de...ed to the hangar at Lakehurst, ...J., where pairs of the 246-ft. span ...ch trusses are framed together on ... ground and raised in three erec... units by two stiffleg derricks ...unted on 145-ft. high traveling ...ers. The horizontal trusses over ... doors, weighing 330 tons each, ... raised to the tops of their con...te tower supports by counter...ights.

...In levelling up the James St. ...dge across the Kaw River in Kan... City, Kan., to improve flood clear...ce, the three-span trusses were ...sed a maximum of 6½ ft. by an ...genious jacking arrangement. Hy...ulic jacks supported on columns ...addling the end pin connections ...ed the trusses through straps en...ging the truss pins. Raising was ...rt of a bridge repair program fol...ing a severe deck fire.

...Garbage disposal by sanitary fill ... increased tremendously in the ...t few years, so that San Fran...co's experience of ten years is ...rthy of wide attention. Technique, ...ipment, and rate of fill settle...nt are discussed in an article to ... published in the next issue.

...OOKING AHEAD

...Transplanting a pipeline to speed ... oil deliveries to the East Coast ...s one of the rush construction ...bs of the past winter. How the ...4 miles of 8-in. pipe was dug up ...Texas, reconditioned and relaid ...ross Northern Florida is the sub...t of an article to be published ...on.

...Keeping construction jobs safe is ...e of the major responsibilities of ...ery superintendent. TVA, out of ... extensive construction experi...ce, has developed safety methods ...t have grown in effectiveness with ...h job undertaken, so that the pro...ures used and the results achieved ... Douglas Dam merit close study. ... article to be published soon is ... of usable safety suggestions.

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From .....

To .....

Signed .....

Permissible Construction Projects Broadened

Reinforcing Steels Available for War Projects and Buildings to Serve Useful Purposes After the War

Because reinforced concrete construction requires only a minimum of critical steel, and the facilities for fabrication of this type of steel do not conflict with more essential jobs, reinforcing steel is now recommended for practically every type of wartime building.

War Emergency Applications

Industrial and military construction, where it can be shown that by its use the war effort will be better served or protected, is permitted. General applications such as: foundations, grade beams and lintels, retaining walls, precast concrete piling, pressure pipe, sewer pipe, manhole rings and covers, tanks, bridge superstructures, runways and flight strips, slabs over boilers also are permitted.

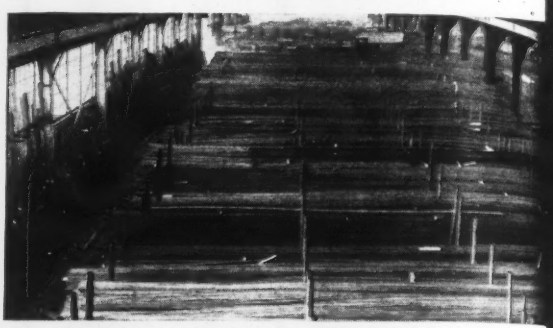
Possible Post-War Service

Generally essential civilian-type construction, which may serve a useful purpose after the war, is approved. Public Utilities of all kinds, hospitals, industrial structures and additions to present facilities, schools, multi-family dwellings, strategic roads and bridges, etc. are listed.

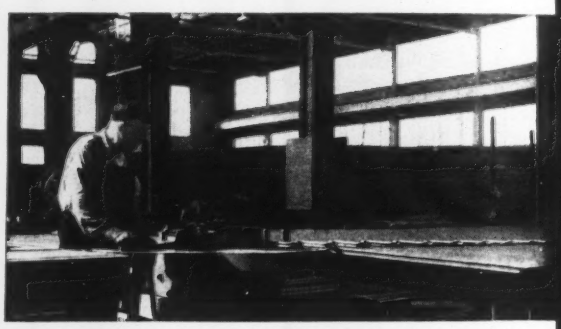
Naturally, all building plans must have WPB approval. And it is suggested that maximum use be made of removable metal forms and used forms lumber now in contractors' yards. For complete list see Amendments 1 and 2 to the "Critical Construction Materials Design Guide, issued February 2, 19[illegible]

Reinforcing Steel in Stock

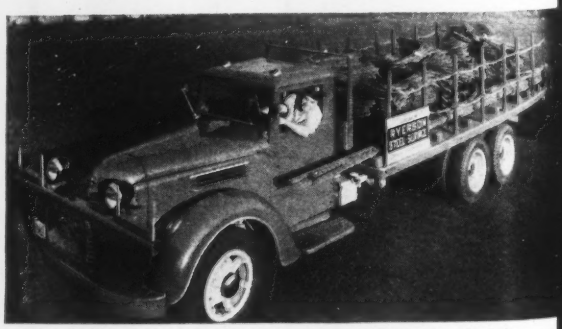
Reinforcing steel in stock for immediate shipment. Call Ryerson for a complete Reinforcing Steel-Service with adequate steel stocks and fabricating facilities. We'll arrange for the removable forms, too. Our engineers will gladly work with you every step of the way from estimates to final delivery. Experienced crews handle the cutting and forming, to exact specifications. Deliveries are scheduled with the progress of your job. Each load is tagged for quick assembly to expedite quick placing. Every type of construction steel and accessory is in stock including a fabricating shop for structural steel work.



Ample stocks of Reinforcing steel on hand at Ryerson.



Complete Cutting and Fabricating Facilities available.



Deliveries scheduled with the progress of each job.

RYERSON
REINFORCING
STEEL-SERVICE

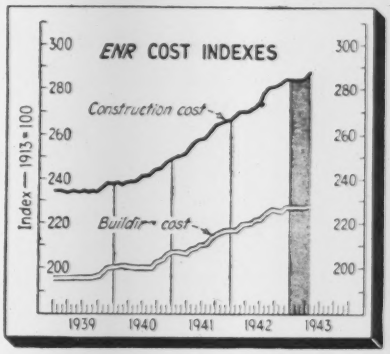
Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Detroit, Cleveland, Cincinnati, Buffalo, Boston, Jersey City, Philadelphia

ONTHLY CONSTRUCTION BUSINESS SUMMARY

ENR CONSTRUCTION VOLUME AND NEW CAPITAL . . . . FHA MORTGAGES

(,000 omitted)	March 1942 (4 wk.)	March 1943 (4 wk.)	% Change	Three Months 1942 (13 wk.)	Three Months 1943 (12 wk.)	% Change†
ental U. S. Construction	$729,485	$305,973	−58.0	$1,993,088	$839,041	−54.0
Construction	67,299	29,983	−55.0	187,704	82,042	−53.0
Construction	662,186	275,990	−58.0	1,805,384	756,999	−55.0
	616,398	263,708	−57.0	1,639,685	727,848	−52.0
New Productive Capital	$46,991	$47,179	+ 0.4	$1,419,454	$62,718	−95.0
e Investment	45,571	44,091	− 3.0	162,250	58,130	−61.0
l (non-federal work)	1,420	3,088	+118.0	15,249	4,588	−67.0
l (federal work)	.....	.....	.....	1,241,955	.....	.....
Mortgages Selected for Ap-	$76,059	.....	.....	$192,657	.....	.....
al (Title II)	114,022	.....	.....	235,386	.....	.....
(Title VI)						

†Adjusted for difference in number of weeks.



ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
April, 1943	288.80	138.83	227.50	122.98	.....	.....
Mar., 1943	285.24	137.11	226.66	122.53	228	100
Feb., 1943	283.48	136.27	226.90	122.66	231	101
Jan., 1943	283.45	136.25	226.87	122.64	172	76
Dec., 1942	283.69	136.37	226.63	122.51	227	100
Nov., 1942	283.64	136.35	226.58	122.48	462	202
Oct., 1942	282.44	135.77	225.90	122.11	421	185
Sept., 1942	281.61	135.37	225.46	121.88	544	238
Aug., 1942	281.61	135.37	225.39	121.84	622	273
July, 1942	277.65	133.46	223.45	120.79	736	323
June, 1942	274.19	131.80	221.18	119.56	752	330
May, 1942	272.30	130.89	220.14	119.00	821	360
April, 1942	271.78	130.64	219.55	118.68	569	249
Mar., 1942	269.71	129.65	218.88	118.32	578	253
1942 (Av.)	276.31	132.82	222.39	120.22	553	243
1941 (Av.)	257.84	123.95	211.46	114.32	375	164
1940 (Av.)	241.96	116.31	202.81	109.64	269	118
1939 (Av.)	235.51	113.21	197.44	106.73	211	92

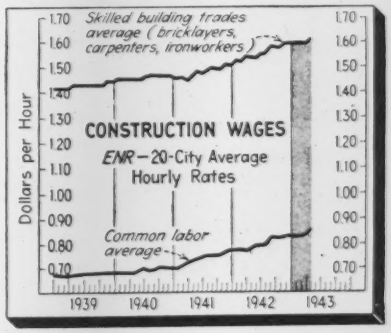
NSTRUCTION COSTS . . . . WAGE RATES . . . . MATERIAL PRICES

	April 1942	April 1943	% Change	Change March to April 1942 Mar.	1942 Apr.	%	1943 Mar.	1943 Apr.	%
Construction Cost 1913 = 100‡	271.78	288.80	+6.3	269.71	271.78	+0.8	285.24	288.80	+1.2
Building Cost Index, = 100‡	219.55	227.50	+3.6	218.88	219.55	+0.3	226.66	227.50	+0.4

‡Does not reflect increased costs due to more overtime, lower labor efficiency, delivery delays, etc.

ENR 20-CITIES AVERAGE

on Labor	$0.788	$0.858	+8.9	$0.780	$0.788	+1.0	$0.842	$0.858	+1.9
Labor (Av. 3 trades)	1.541	1.613	+4.7	1.538	1.541	+0.2	1.606	1.613	+0.4
ayers	1.645	1.703	+3.5	1.638	1.645	+0.4	1.700	1.703	+0.2
ral Ironworkers	1.602	1.671	+4.3	1.599	1.602	+0.2	1.661	1.671	+0.6
sters	1.376	1.465	+6.5	1.376	1.376	0	1.457	1.465	+0.5
t, per barrel	$2.60	$2.61	+0.4	$2.60	$2.60	0	$2.61	$2.61	0
ring steel, cwt.	2.62	2.74	+4.6	2.61	2.62	+0.4	2.74	2.74	0
steel shapes, base	2.10	2.10	0	2.10	2.10	0	2.10	2.10	0
per ton	1.21	1.21	0	1.21	1.21	0	1.21	1.21	0
r, 2x4 Fir, per M ft.	47.88	51.05	+6.6	47.80	47.88	+0.2	51.05	51.05	0
r, 2x4 Pine, per M ft.	42.29	44.66	+5.6	42.06	42.29	+0.5	44.01	44.66	+1.5
common, per M	15.33	15.63	+2.0	15.28	15.33	+0.3	15.66	15.63	−0.2
-mixed concrete, c.y.	7.19	7.37	+2.5	7.20	7.19	−0.1	7.39	7.37	−0.3
clay tile, 3x12x12	76.62	78.93	+3.0	75.91	76.62	+0.9	78.93	78.93	0
asphalt, cars, ton	15.36	15.21	−1.0	15.31	15.36	+0.3	15.12	15.21	+0.6



MATERIAL SHIPMENTS . . . . . BUILDING PERMITS

	March 1942	March 1943	% Change	Feb. 1943	% Change Feb. Mar.
% operating capacity) A. I. S. I.	98.1	99.0	+0.9	98.1	+0.9

	February 1942	February 1943	% Change	Two Months 1942	Two Months 1943	% Change
ated Structural Steel, tons, A.I.S.C.	164,599	104,836	−36.3	332,352	210,668	−36.6
t, thous. bbl. U. S. B. of M.	8,293	8,656	+4.4	17,408	17,297	−0.6
ng Permits, Dun & Bradstreet						
0 omitted)	$88,565	$28,677	−67.6	$150,889	$57,496	−61.9

COST OF LIVING INDEXES . . . EMPLOYMENT

	February 1942	February 1943	% Change	Mar. 1943	% Change Jan. Feb.
Living Index, N. I. C. B.	95.1	101.8	+7.0	101.4	+0.4
(Housing) Index, N. I. C. B.	90.4	90.8	+0.4	90.8	0
Employment (est.) thous., B. L. S.	35,062	37,995	+8.3	37,862	+0.3
ruction Employment (est.) thous. B. L. S.	1,594	1,319	−17.2	1,470	−10.2

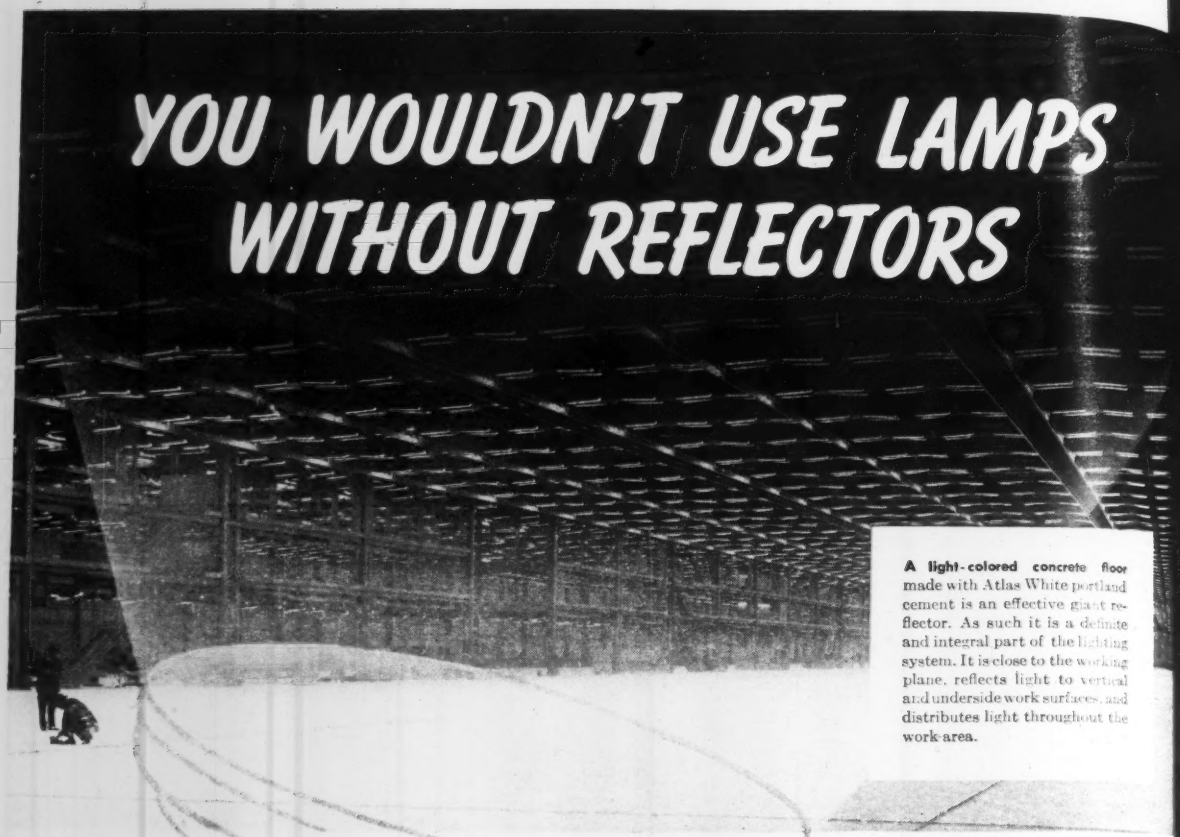
ENGINEERING CONSTRUCTION CONTRACTS——ENGINEERING NEWS-RECORD——MARCH, 1943

neering News-Record *reports continental U. S. construction projects of the following minimum costs—waterwork excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000

Four Weeks—Thousands of Dollars (000 Omitted)

ic Works	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States March 1943	United States Three Months 1943	United States Three Months 1942	Canada
Waterworks	97	260	1,275	52	1,245	396	**3,325**	**11,677**	25,714	96
Sewerage	.....	313	1,611	1,467	916	585	**4,892**	**9,984**	21,468	60
Bridges, public	.....	605	21	694	601	78	**1,999**	**4,905**	18,659	.....
Earthwork and waterways	326	99	329	.....	346	261	**1,361**	**4,617**	153,520	32
Streets and roads	100	1,637	2,875	2,660	4,004	2,255	**13,531**	**36,155**	85,761	[5,380
Buildings, public	5,399	22,708	29,337	13,208	21,307	56,385	**148,344**	**459,780**	1,262,092	450
Unclassified, public	891	16,519	18,638	10,877	45,993	9,620	**102,538**	**229,881**	238,170	1,013
public	**6,813**	**42,141**	**54,086**	**28,958**	**74,412**	**69,580**	**275,990**	**756,999**	**1,805,384**	**7,031**
Federal government (included in above classifications)	6,813	39,910	51,417	25,556	72,438	67,574	**263,708**	**727,848**	1,639,685	.....
te										
Bridges, private	.....	.....	.....	.....	50	.....	**50**	**1,550**	**205**	.....
Industrial buildings	650	2,216	150	826	4,795	1,186	**9,823**	**37,944**	77,318	630
Commercial buildings	2,300	4,818	.....	1,070	2,609	5,980	**16,777**	**35,233**	91,305	400
Unclassified, public	.....	140	.....	25	3,075	93	**3,333**	**7,315**	18,876	122
private	**2,950**	**7,174**	**150**	**1,921**	**10,529**	**7,259**	**29,983**	**82,042**	**187,704**	**1,152**
Engineering Construction:										
h, 1943 — 4 weeks	**9,763**	**49,315**	**54,236**	**30,879**	**84,941**	**76,839**	**305,973**	.....	.....	**8,183**
uary 1943 — 4 weeks	14,638	28,850	68,562	45,453	57,036	91,703	**306,242**	.....	.....	5,370
h, 1942 — 4 weeks	29,671	96,233	168,621	99,961	251,794	83,205	**729,485**	.....	.....	14,825
e Months — 1943	**36,680**	**101,635**	**183,315**	**85,220**	**207,300**	**224,891**	.....	**839,041**	.....	23,084
ee Months — 1942	69,562	315,530	515,701	317,212	464,698	310,385	.....	.....	1,993,088	31,720

YOU WOULDN'T USE LAMPS WITHOUT REFLECTORS



A light-colored concrete floor made with Atlas White portland cement is an effective giant reflector. As such it is a definite and integral part of the lighting system. It is close to the working plane, reflects light to vertical and underside work surfaces, and distributes light throughout the work area.

But how about the floor as a *giant* reflector? A light-colored concrete floor—one made with *white* portland cement instead of standard *gray* portland cement or other darker materials—is the *biggest* reflector of all. As a salvager of waste light, a light-reflecting concrete floor is a real part of the plant lighting system.

This is shown in aircraft plants built for Boeing, Consolidated, Douglas, North American and others. In the Consolidated installation at Fort Worth, a lighting survey by General Electric shows that the concrete floor built with Atlas White cement compared with a gray-cement floor in the same plant—

- *Distributes more light throughout the working area;*
- *Reduces shadows and dark areas;*
- *Reflects 20% more light to vertical work surfaces;*
- *Reflects 61% more light to underside work surfaces.*

Thus the floor is a real part of the lighting system. Because it salvages waste light, a light-reflecting concrete floor made with Atlas White portland cement—

- *Makes seeing easier, quicker, and more comfortable;*
- *Reduces eye strain, headaches, and absenteeism;*
- *Reduces accidents, errors, spoilage, and shutdowns;*
- *Increases quantity and quality of production.*

Mail the coupon for new book, "Light From Floors." It gives detailed information on the value, installation, and maintenance of light-reflecting concrete floors made with Atlas White portland cement. Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York City.

HOW ABOUT MAINTENANCE?

White-cement floors encourage cleanliness. They are light in color, have a minimum of joints to collect dust and dirt, and a relatively non-absorbent surface. Experience in the Consolidated plant shows they are easy to clean, easy to keep clean, and retain their reflection advantage. Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

OFFICES:

New York, Chicago, Des Moines, Philadelphia, Duluth, Albany, Boston, Kansas City, St. Louis, Birmingham, Cleveland, Pittsburgh, Minneapolis, Waco.

ATLAS WHITE CEMENT

FOR LIGHT-REFLECTING FLOORS

Universal Atlas Cement Company, Chrysler Building, New York, N. Y.

Please send me copy of new book, "Light from Floors."

Name_____

Position_____

Company_____

Address_____

GINEERING NEWS-RECORD • APRIL 8, 1943 • VOLUME 130 • NUMBER 14

Army Engineer equipment to be transferred to troops

Construction equipment acquired by purchase and by recapture provisions is to be sent abroad. Existing contractor-owned machines must serve domestic needs.

The Corps of Engineers is starting to ak up its huge pool of construction ipment—acquired over the past two rs by purchase and by exercise of recapture clause in fee contracts. e pool, which amounts to a substan- proportion of the total equipment cks of the country, was put together a time when the Corps was anxious insure that it would have plenty of ipment for its projects. For the ming year, however, estimates of the ipment required for domestic con- ruction projects are much lower than the past, while demand for equipment be used by troops is rising all the me—rising so fast that manufacturers' tput of new equipment is unable to isfy it.

The Engineers, therefore, are initiating broad program of repair and rehabili- tion of their used equipment to fit it r troop use. The program will result withdrawal of large quantities of ipment from use on domestic work. he amount withdrawn will depend on w much of the pool equipment is found be in suitable condition. Late model ipment in good shape, which can be habilitated into first class condition, ill be sent abroad for troop use. Ma- hines not quite as good will be assigned troop training in this country, while ipment too old or light for this serv- will be used for maintenance work military installations.

The repair work will be done, under ntract, by equipment distributors up the limit of their capacity, but it is pected that substantial use will also ve to be made of Army shops.

Meanwhile, for next year's program domestic construction, the Engineers an to rely as much as possible on ntractor-owned equipment. Although many firms are low on machines, so many contractors are being released by the completion of current work that it believed contractors with equipment n be found for all projects. Such contractors will be given preference in the award of work, and, in any case, it is expected they will be able to bid lower.

Indicative of the pressure on the supply of new equipment created by military and Lend-Lease demand is the WPB announcement of last week that power crane and shovel manufacturers now have a backlog of orders sufficient to keep them busy at present rates for about eight months. January shipments by 17 manufacturers representing 90 percent of the business totalled $14,815,000, of which $10,032,000 was shovels and cranes, about $2,370,000 consisted of armament, while the remainder was scattered among concreting equipment, welders, trailers, etc.

• • •

Equipment going to Alaska to bring higher rentals

An increase of 25 percent in the maximum monthly rental rates for Alaskan construction and road maintenance equipment was authorized March 25 by the Office of Price Administration. The action was taken to assure the leasing to Alaskan war projects of enough equipment to keep operations going.

It is pointed out that a study of over-

(Continued on next page)

Chicago Sun Photo

First trains run in Chicago subway

Strictly on an exhibition basis, but running nevertheless, the first link of Chicago's new subway system went into operation last week. Trial runs, over the 4.9-mile State St. line, with officials aboard, inaugurated the service, while the man in the street was later given the opportunity to ride if he would buy a war bond.

Principal significance in the event is that it marks another step in Chicago's comprehensive program of traffic improvement. Work on the subway began in 1938, aided by a PWA 45 percent grant of $18,000,000. Involved were 7.7 miles of line, 4.9 of which was in the State St. line, and the remainder in the so-called Dearborn St. loop. This first financing and construction step is to be followed by three others, which will add 42.8 miles of line to the system at a cost of some $225,000,000. At present the State St. line is nearly complete, but the Dearborn St. line is still under construction. Hand mining methods on the State St. line were described in the Aug. 1, 1940, issue, p. 159, and shield driving procedure on the Dearborn St. line in the Jan. 30, 1941, issue, p. 158. Because of equipment difficulties the date for general operation of the subway is indefinite.

haul and repair costs made by OPA indicates that the present ceiling rentals established by Maximum Price Regulation No. 134 are not adequate to cover the unusual costs incurred by Alaskan owners of equipment. The severe conditions of weather and terrain and the primitive housing and upkeep conditions cause the Alaskan equipment to be exposed to greater wear and tear than is true for equipment use for similar work in the United States.

The action does not change daily or weekly rental rates established by the regulation and applies only to the dollars-and-cents monthly rates. Nor does the amendment (No. 7 to Maximum Price Regulation 134) affect the rates provided for equipment leased to the U. S. Army Engineers, which were established in a previous action at double the ceiling rate.

• • •

Private building aided by release of FHA funds

The Federal Housing Administration has been authorized by Congress to issue $1,200,000,000 more insurance for war housing mortgages in the next 18 months. This authorization means that banks and other financial institutions will not hesitate to lend to private builders inasmuch as the risk will be backed up by the credit of the government.

The shortage of materials that bothered builders last year has been remedied somewhat by an AA-3 priority rating, and furthermore, WPB now permits private builders to include more substitute materials and additional floor space to make houses more salable now and in the postwar market.

The government itself, however, will continue to have a big share in the housing program. So far building quotas have been about 50-50 between private and public interests.

The current housing program (fiscal 1943) calls for 615,000 units of new construction, plus 650,000 accommodations in structures already existing.

This is the way the units through February 1943, are divided between private and public housing:

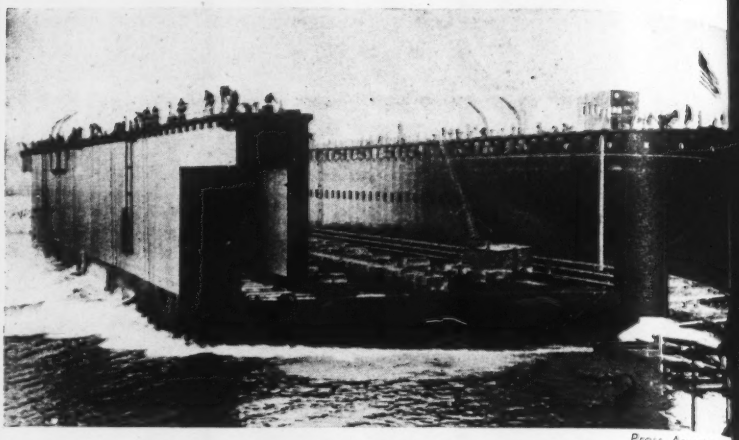
Private Housing Units

Started	105,000
Completed	108,000
Under construction	73,000
To be started	150,000

Public Housing Units

Started	211,000
Completed	144,000
Under construction	241,000
To be started	130,000

Notwithstanding the speed-up in the construction of new units, conversion of existing structures is said to be the quickest way to get new housing because the remodeling job does not take so long as new construction, and averages only about $1,300 a unit. The conversion program is one-quarter of the way toward its goal of 40,000.



Press Association

Navy unveils some of its new floating docks

Last week marked a change in Navy policy respecting information on one of its most interesting construction operations — the building of radically new designs of floating drydocks. At Newburgh, N. Y., the center section of a light cruiser dock was photographed while being launched at the Chicago Bridge & Iron Co. yards, and in Washington, Rear Admiral Ben Moreell, chief, Bureau of Yards and Docks, revealed details of a seagoing sectional dock for battleships and heavy cruisers, unlike anything any other navy in the world can boast of.

The light cruiser dock, pictured above, is made up of three sections. Each section will be provided with cranes capable of lifting another section out of the water for repair. The battleship-heavy cruiser docks are even more unusual. They, too, are sectional docks, but each section has the unusually large capacity of 10,000 tons. Ten sections joined together will accommodate the largest battleship, and seven sections a heavy cruiser. A total of 65 sections is being built.

Because ships may have to be repaired anywhere in the world, these sections are designed as seagoing vessels. They may be towed at knots, but are designed to permit the tion of propulsion machinery, so that they sail "on their own". When the sections are ing moved, the side walls are folded cutting down wind resistance and provid low silhouette against prying eyes from ships. Arriving at their destination, the tions are sunk by submersion machinery at the same time buoyancy chambers at sides to operating position. Various type floating machine shops have also been des to go along with the floating drydocks.

In addition to these large units, the also building 35 floating docks for 3 destroyers. All of this work is a part $511,000,000 drydock program, institu 1940, on the theory that "the cheapest quickest way to build a ship is to repair already built", according to Admiral In the last five years, the Navy has comp or initiated construction of 183 docks floating and graving, or stationary, w aggregate capacity greater than all the dock facilities in the world, including the United States, which existed in 1937.

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Road surveys in Bolivia to be made by the PRA

Surveys for the location of a road from Cochabamba to Santa Cruz, Bolivia, and from Sucre to Camiri, Bolivia, have just been made the subject of an agreement between the Public Roads Administration of the U. S. Federal Works Agency and the Bolivian Development Corp. under the guidance of the U. S. Department of State. The corporation is owned by the government of Bolivia. (An account of the reconnaissance surveys recently conducted by the PR given on p. 482 of this issue.)

Under the agreement the Public R Administration is to take charge engineering work on the project vide a resident engineer, and five of-party for conduct of surveys wit ditional engineering personnel is be deemed necessary. It agre utilize and train qualified Bolivian sonnel to as great extent as p consistent with the expediting work.

That Bolivia intends to push its program rapidly is indicated by stipulation that plans, specifications estimates shall be prepared to fac early construction of demonstration tions near the termini.

The Public Roads Administration assigning engineers for this work it is expected that they will leave Bolivia within a few weeks.

Blighted city areas will be aided by postwar plan presented to Congress

ill has been introduced to establish an Urban Redevelopment gency with a quarter-billion dollar fund. Money would be lent to unicipalities for the purpose of buying blighted areas

arking the first definite formulation egislative terms of a major postwar ram, a bill was introduced in Con- s last week designed to put into ef- the scheme for a planned, broad- e rehabilitation of the blighted areas merican cities, which has been devel- d over several years by A. W. Han- economist of the Federal Reserve ard (*ENR*, Oct. 23, 1941, p. 547). bill was introduced by Senator omas of Utah, and has been referred Senator George's committee on post- r planning.

Although the measure contains provi- n for immediate appropriation of ds for advance planning, it is most ikely that the present predominantly ti-New Deal Congress will take any tion on it. It holds significance, how- er—as does the recent report of the ational Resources Planning Board *ENR*, March 18, p. 387)—as a pre- ew of the type of program to be ex- ted if the present administration re- nes power after the war.

The theory motivating the bill is based two assumptions: (1) The reason r the persistence of blighted areas in e center of large cities is inflated land lues, which make it impossible to ild new structures on the land; (2) e only way to overcome this situation for the federal government to take e loss involved in writing down the lue of the land.

Quarter-billion dollar agency

The bill, therefore, sets up an Urban edevelopment Agency and assigns to it quarter-billion dollars. The URA would e empowered to lend money to munici- alities for the purpose of buying lighted areas. The cities would prob- bly use part of the land for public rposes—parks, etc.—but most of the nd would be rented for commercial, dustrial and residential use. The rents ould be set low enough to make im- rovement of the land an economically ttractive investment. The only security r the federal government's loan to the unicipality would be the rentals de- ved from the land, so the government obably would take a substantial loss the transaction.

As a condition for receiving the loans, he cities would be required to set up n official planning agency and draft plan for the physical development of he city or metropolitan area and, spe- ifically, for the development of the land to be bought. The plan would have to be satisfactory to URA, and lessors of the land would have to conform to the plan.

Objective would be planned development of cities and, equally important, stimulation of a huge building program, which would be mostly at private expense, since the federal contribution would be limited to clearing away inflated land values.

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U. S. begins producing synthetic rubber

An extensive new plant, built with skillful engineering economy in strategic materials, on March 31 turned out the government's first synthetic rubber in compact bales destined to keep Allied war machines rolling to victory.

With a 30,000-ton annual capacity, enough rubber for some 4,000,000 tires will be produced by this Baton Rouge, La., plant, the first one constructed by the government under the Baruch program to make synthetic rubber from petroleum. Private industry has had some relatively smaller units in operation for some time.

Built by the H. K. Ferguson Company of Cleveland and New York, and equipped by the Blaw-Knox Company of Pittsburgh, both working under management supervision of the Firestone Tire & Rubber Company, the plant is financed by the Defense Plant Organization and is to be operated by Copolymer Corporation, an organization of a number of the small rubber companies.

Given an original schedule of 4½ months in which to provide useful occupancy of the buildings, the Ferguson Co. attained its goal a full month earlier.

Many difficulties and obstacles were overcome by engineering and construction personnel in achieving the speed record, according to Harold K. Ferguson, president of the Cleveland building organization.

"When we couldn't get immediate delivery on heavy power equipment for grading, we used every available mule in the territory," Mr. Ferguson said. "When we saw what rain did to the soft Louisiana mud, we planked up all our roadways with 3-in. oak boards, and when the mud seeped through the planking, we repeated the operation and put planks atop planks."

The plant was designed to conserve as many critical materials as possible. Buildings are of masonry and timber construction with wood truss frames. There are approximately 15 structures, including an administration building, utility building, rubber storage and process building, pigment recovery structure, polymerization building, pigment storage building, purification building, boiler house and gate house. In addition, there are a tank farm for butadiene storage and a water cooling tower.

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Delaware Aqueduct now serves New York City

As an emergency measure to safeguard New York City's water supply from bombing attacks and sabotage, 42 miles of the 85-mile-long Delaware aqueduct, the longest bombproof tunnel in the world, have been placed in limited operation, and the tunnel is now actually bringing water into the city from the up-State watersheds heretofore tapped by the vulnerable Croton and Catskill aqueducts. The Department of Water Supply, Gas and Electricity disclosed that two unspecified sections of the tunnel are now in operation, although originally it was not expected the water would be flowing through the bore until 1945.

The $290,000,000 aqueduct which has been almost entirely tunnelled for its whole length, was drilled through solid rock hundreds of feet underground between the Rondout Reservoir at Lackawack, N. Y., and New York City. Eighteen feet in diameter, lined with concrete, and operated by high-pressure pumps, the tunnel links the Croton and Catskill watersheds and will eventually tap the East Branch of the Delaware River.

The opening of the two sections of the Delaware Aqueduct nearly two years ahead of schedule, makes it unnecessary for the city to rely now upon the Croton and Catskill Aqueduct which are of "cut-and-cover" construction—that is, running under, on, or over the surface of the ground depending on the terrain.

The Delaware Aqueduct was designed to end for several generations the recurrent water famines that have plagued New York City. Starting at Rondout Reservoir in the Catskills, the bore drives straight east, sometimes more than a thousand feet underground, deep under the Hudson River, to the Croton watershed, where it links to the Croton reservoirs and continues down to the Kensico Reservoir in Westchester county. Finally it connects with the city tunnel that was put in service in 1936.

The engineering project in connection with this aqueduct was one of the greatest of this kind. The engineers met and overcame many new problems.

Six millions for postwar designs in War Department bill

Appropriation, approved by House, also cuts deep into construction money for present projects. Panama Canal work halted.

A War Department appropriation for civil functions less than a fifth the size of the fund for the current fiscal year was approved by the House last week. Included in the bill, however, is $6,000,000 for preparation of designs on authorized projects to be undertaken after the war. Of this, $2,000,000 is for navigation projects and $4,000,000 for flood control.

The bill appropriates a total of only $63,032,683, as compared with $343,983,826 this year. The 1944 money, however, will be supplemented by some carryover of funds from fiscal 1943. Biggest cuts were made in money for general flood control and for work at the Panama Canal.

The measure carries no appropriation for general flood control work, but it is proposed to use $21,000,000 of holdover funds—including $10,000,000 for Denison Reservoir, $6,415,000 for Norfork Reservoir, Ark., and $4,261,000 for Dale Hollow Reservoir, Tenn. This compares with $128,961,000 appropriated last year. For new work on the Mississippi, $7,035,000 is appropriated, and $2,600,000 for the Sacramento project.

New river and harbor work is cut to $3,200,000, of which nearly half is for New York Harbor.

The appropriation for the Panama Canal is cut from the current year's $107,516,810 to a mere $8,724,000. The reduction arises from completion of most of the protective work at the canal and stoppage of construction on the third-locks project; on this auxiliary waterway, with a total cost of $282,000,000, about $86,000,000 has been spent. Stoppage results from material and transportation difficulties.

A total of about $37,375,000 is being carried to next year from this year's funds, so that money actually available in fiscal 1944 for civil functions will run to $100,436,000. In addition to the carryover money, about $84,500,000 of 1943 money was impounded by stoppage of projects and the like will not be spent.

January war project completions set at $1,128,000,000 by WPB

Completed government-financed war projects construction totaled $1,128,000,000 for January, 1943, according to WPB statistics. Almost half of this volume, $520,000,000, was spent for non-industrial military construction — air fields, camps, etc.; 22 percent was for industrial plants; 27 percent for machinery and equipment installed in government-financed plants; and 6 percent was spent for housing and community facilities.

The January volume declined 8 percent from December, and was 29 percent lower than the peak of $1,598,000,000 attained in August, 1942. The 1943 opening month's total, however, was 92 percent above war construction completed in January, 1942.

WPB monthly dollar volume for completed construction by type of work during 1942, and so far in 1943 is shown in the accompanying table. In addition, the index values, based on completed project volume in November, 1941, are tabulated.

GOVERNMENT-FINANCED WAR PROJECT CONSTRUCTION COMPLETED, 1942 and 1943

(Millions of Dollars)

Month	Tot. Constr. Completed	Index Nov. 1941 Base	Ind'l. Building	Mach'y. & Equipment	Military Structures	Housing, Local Pub. Works
1942 Jan.	$589	103	$165	$138	$256	$30
Feb.	650	114	213	148	260	29
Mar.	803	141	223	168	378	34
Apr.	957	168	240	193	484	40
May	1,102	193	291	229	539	43
June	1,282	225	314	268	648	52
July	1,508	265	360	268	828	52
Aug.	1,598	280	410	262	866	60
Sept.	1,566	275	396	290	805	75
Oct.	1,449	254	383	298	699	69
Nov.	1,380	242	324	311	683	62
Dec.	1,226	215	284	317	561	64
	$14,110	206 (Av.)	$3,603	$2,890	$7,007	$610
1943 Jan.	1,128	198	244	299	520	65

California road workers eligible for deferment

The War Manpower Commission declared that maintenance and repair of highways are essential to the war effort, giving the state division of highways of California authority to ask occupational deferments for employees. C. H. Purcell, director of the state department of public works, commented as follows:

"I consider this ruling of the WMC one of the most important war decisions yet issued. It will enable us to keep our highway equipment in service and will go a long way toward helping us to maintain a sufficient force of maintenance men to keep our highways from going to pieces during the war emergency."

The WMC explains this ruling by saying:

"It should be clearly understood that occupational deferments are considered on an individual basis. It is the responsibility of the local selective service board to determine the occupational deferment status of the registrant."

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Oil line and more roads under way in Far North

War Department construction operations in Canadian territory adjacent to Alaska, heretofore considered secret by this country, were described in some detail in the Canadian House of Commons last week. Involved are an oil pipeline from Norman Wells, 125 miles south of the Arctic Circle and near Great Bear Lake, to Whitehorse, and a highway from Peace River in Northern Alberta to Providence, on Great Slave Lake, in the Northwest Territories, where it connects with the Mackenzie River waterway flowing northward to the Arctic Ocean and passing through Norman Wells. Both the pipeline and the highway will be instrumental in getting oil out of this Far North outpost.

The pipeline, which will connect with the Alcan Highway at Whitehorse, is 600 miles long, and will carry oil products from a refinery established at Norman Wells in 1940. The first well was drilled at Norman Wells in 1921. But little development occurred until 1939, when mining in the region created a demand for diesel fuel. Now, war has greatly increased the demand for petroleum products, and the Canadian government is pushing oil prospecting and well development in the region. The new highway will get supplies in first.

It was also revealed that numerous feeder roads are also being built in various points in Northern Canada to the Alcan Highway.

Expansion planned in raw material capacity

Some relaxation in the WPB rule forbidding approval for construction of new facilities unless they will be in production in 1943 is now possible, Donald Nelson intimated last week before the Senate Small Business Committee. For just a year now, Jan. 1, 1944, has been the date of informal deadline for construction projects. If they could not be finished by then they would not be approved. This has been an important criterion in current WPB efforts to cut down on the 1943 construction volume.

The WPB head did not indicate in what respect the formula might be relaxed, but from other sources in the War Production Board it is learned that what he had in mind was expansion of facilities for production of raw materials. There is no thought of stepping up the program for construction of manufacturing facilities; the country is already overbuilt on such capacity in relation to the supply of raw materials.

Ever since vice-chairman Charles Wilson became the leading force in WPB, increased production of raw materials has been a major objective. So far this has been directed at increasing the output of existing facilities, but now thinking is turning toward new capacity. At least three major programs are being considered, aimed at expanding output of steel, copper, and aluminum.

Thinking on the steel program goes as far as 10,000,000 additional tons a year of steel capacity. The 5,000,000 tons of new iron capacity may be provided in the form of sponge iron to avoid some of the transportation difficulties associated with blast furnace expansion. An incidental effect would be a new pressure on scrap to provide the extra 5,000,000 tons required.

Chief reliance for new copper sources is to be placed on tapping of the numerous pockets of rich ore which are too small to be worth the cost of a shaft on a normal commercial basis. The new shafts would be sunk at government expense.

The aluminum program would involve construction of new aluminum plants designed to utilize low-grade domestic ore. WPB has had some bad scares in the past year when the submarine danger interfered with shipment of bauxite from South America.

Six Russian engineers have arrived at Knoxville, Tenn., to study designs of several Tennessee Valley Authority power houses and equipment for utilization in similar projects in Soviet Russia. The Russians came here through a Lend-Lease arrangement with the procurement division of the Treasury Department.

JOBS OF THE WEEK

ROADS, Florida

Florida State Road Department, Tallahassee, received lowest bid for paving 42 miles Overseas Highway, Monroe Co., from Groves, Lundin & Cox Co., Minneapolis, Minn., $1,396,916. J. H. Dowling, Tallahassee, chief engineer.

APARTMENTS, Stemmers Run, Md.

Gross Morton Corp., Jamaica, N. Y., has been awarded contract 106 apartments, by Mars Estates, Inc., Cyril H. Hebrank, architect, Baltimore, Maryland. Estimated cost $2,000,000.

FACILITIES, Pensacola, Fla.

Bureau of Yards & Docks, Navy Dept., Washington, D. C., awarded contract to construct facilities at Naval Air Station, to Hardaway Contracting Co., Columbus, Ga., $1,390,950.

HOSPITAL ADDITIONS, California

K. E. Parker Co., San Francisco, Calif., will construct additional hospital facilities, at Oakland; outlying field at Monterey, and at Naval Air Station, Alameda, to cost $2,122,000. Bureau of Yards & Docks, Navy Dept., Washington, D. C., awarded contract.

IMPROVEMENTS, New York

Mount Vernon Contracting Co., Mount Vernon, N. Y., has been awarded contract to build improvements in Orange Co. by U. S. Engineers, New York, N. Y., under $5,000,000.

BUILDINGS, AIRFIELD, Nebraska

U. S. Engineers, Omaha, Neb., awarded additional buildings, airfield in Buffalo Co. to Peter Kiewit Sons' Co. and Bighorn Construction Co., Omaha, Neb., and Sheridan, Wyo. Estimated cost $500,000-$1,000,000.

HOSPITAL, Vallejo, Calif.

Barrett & Hilp, San Francisco, Cal., has been awarded contract hospital by Public Buildings Administration, Washington, D. C. $1,070,000. D. D. Stone and L. B. Mulloy, San Francisco, associated architects.

RESIDENCES, Fort Worth, Tex.

Fritz Hunter, White Settlement Rd. and University Pl., awarded contract housing project, including single-frame cottages, brick cottages, brick duplexes, and apartments to A. P. Simons, Dallas, $1,500,000.

AIR FORCE INSTALLATION, Ohio

U. S. Engineers, Wright Field, Dayton, O., awarded contract to expand army air force installation at Greene County to Boyle & Co. of Chicago, Ill. Estimated cost $2,000,000.

ROADS, Pennsylvania

State Highway Department, Harrisburg, Pa., awarded contract roads in Beaver County to S. J. Groves & Sons Co., Ridgefield, N. J., $1,172,714; also for road in Delaware County to Francis A. Canuso & Sons, Philadelphia, Pa., $1,115,511. T. C. Frame, Harrisburg, Pa., is engineer.

IMPROVEMENTS, Covington, Ky.

Civil Aeronautics Authority, Chicago, Ill., awarded contract improvements to Frank Mashuda Co., Milwaukee, Wis., $1,858,106.

BUILDING, Oklahoma

U. S. Engineers, Tulsa, Okla., awarded contract for the construction of building, Okmulgee County, to Cowan Construction Co., Shawnee. Less than $2,000,000.

HOUSING, Michigan

Public Housing Authority, Cleveland, O., awarded contract for the construction of housing project to Kuhne Simons Co., Decatur, Ind., $1,962,059. Skidmore, Merrill, Owings & Andrews, Detroit, architects.

HOUSING, Michigan

Public Housing Authority, Cleveland, O., received lowest bid for housing from National Homes Corp., LaFayette, Ind., $1,936,080. Skidmore, Owings & Merrill, Chicago, Ill., are architects.

IMPROVEMENTS, Oregon

Civil Aeronautics Authority, Seattle, Wash., awarded contract for improvements, to Strong, McDonald & White Brothers, Tacoma, Wash. $1,495,932.

Note—Additional bidding and contract news on many projects large and small appear in the Construction News section beginning on page 159.

Action on the Postwar Front

Thought and action on postwar plans for engineering and construction work to provide employment and help prevent a business depression following the war continue to occupy the attention of various governmental bodies and forward-looking officials and groups throughout the country. Following are several of the major plans now being considered and discussed:

Immediate planning to solve the problem of peace-time use of the gigantic war production machine built by the government has been proposed by Jesse Jones, Secretary of Commerce. "We will need to maintain a high level of employment to prevent idleness, suffering and want," said Secretary Jones. "But this does not mean that the government must retain the ownership or the operation of the facilities it has built. Nor does it mean that they should be sacrificed. It means that government and private business must work together to utilize in peace much of the machinery we have created for war. There may be insistence for keeping government in business. There may be extreme pressure to sell to private industry at bargain prices. Congress must decide, and with great deliberation." Picturing the tremendous scope of the government's war production, the Secretary of Commerce noted that the Defense Plant Corporation, a subsidiary of the Reconstruction Finance Corp., of which he is chairman, has built and equipped, and now owns, 1,479 plants at a cost of $7,000,000,000. This is in addition to the plants built by the War and Navy Departments and the Maritime Commission. "We will have a capacity for manufacturing more rubber than we have ever used," Mr. Jones disclosed, "and that fact alone will need to be considered in readjusting world trade and world economy after the war."

A movement to draft a unified and concrete plan of action to guide each of the 48 states in preparing, while the war is still in progress, to meet the postwar problems of unemployment and reconstruction was launched in Chicago by the governors and other executives of sixteen Midwestern States at their recent two-day regional conference sponsored by the Council of State Governments. The program, drafted by a national committee created by the conference, on which representatives of Eastern, Far Western and Southern States also will be invited to serve, will be submitted to all the nation's governors at their annual conference in Columbus, O., in June. If the governors approve the plan, it may become a model for state legislative and executive action dealing with postwar problems. The discussions suggested that two of the major planks in the plan that the national committee will draft may deal with the questions of building up huge reserve funds in the states for road building, educational projects and other public works after the war and of bringing local governments and business and industry into closer cooperation for a joint attempt to create more jobs in the postwar period. Later in the month, similar regional conferences are to be held in New York, Atlanta and San Francisco, at which these plans will be further developed.

An outline of what can be done by waterworks officials and manufacturers to prepare for the postwar period has been submitted by a committee of the New England Water Works Association. Presented as a preliminary program, it lists specific matters on which action should be taken. The report lists twenty activities for waterworks officials to consider, including distribution system studies, replacement of obsolete equipment and renovation of shop and repair facilities. For manufacturers, it is suggested that carefully planned research be increased in scope, present products be improved, and that new materials, such as plastics and laminated wood, be studied. The report urges the association itself to inaugurate an educational program among its members and the public leading to action on postwar activities. E. Sherman Chase, partner of Metcalf & Eddy, consulting engineers, Boston, is chairman of the committee.

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Price relief offered on certain "local" materials

To meet problems created by acute shortages in "regionally-produced" building materials, the Office of Price Administration, on March 27 revised the method by which manufacturers of these materials—such as concrete products, structural clay products, crushed stone, sand and gravel, slag, ready mixed concrete and building stone—may apply for adjustment of maximum prices. The action authorizes regional OPA administrators to provide individual adjustments of maximum prices where shortages exist that will be reduced or eliminated by such price adjustments and where the adjustment will not tend to create a need for price increases in another locality. It is pointed out that the provision for adjustment can be applied only by manufacturers of the building materials specifically listed in the amendment, these being materials customarily produced regionally because of the relatively high freight rates involved in their transportation.

Health "bomb" kills disease-carrying insects

America's fighting men in tropical jungles are now armed against malaria and yellow fever with a new health bomb that exterminates disease-carrying insects. This new weapon is offered by the Westinghouse Electric & Mfg. Co. It is an insecticide dispenser that discharges a spray fatal to disease-spreading flies and mosquitoes but is harmless to humans. The 6-in. metal dispensers, each about the size of a tin can, can be discharged frequently in tents and other quarters wherever troops are stationed in the tropics. They are in the cabin of every airplane, military or civilian, that takes off from a tropical base. The bomb releases a fine mist that remains suspended in space. In the 12 to 14 minutes required for complete discharge, one dispenser will fumigate 150,000 cu. ft. of space, the equivalent of 240 army pup tents, or 50 bombers. The spray can be turned on or off as necessary.

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Severe floods in Mont

The most destructive floods in [illegible] occurred last week in Montana. [illegible] were ascribed to rapidly melting [illegible] Three railroads, the Northern Pa[illegible] Butte Anaconda & Pacific and Mil[illegible] Lines, were using emergency crews [illegible] endeavor to save important bridg[illegible] embankments. Trainloads of ripra[illegible] being rushed into the area around [illegible] work was being continued on [illegible] schedules, and the situation at [illegible] points was reported as critical, p[illegible] larly in the Silver Bow and [illegible] Canyons region.

OBITUARY

…ert G. Wilson, 65, prominent in …ansas engineering circles, died at … Springs March 25. Mr. Wilson … well known as a highway engineer.

…ar K. Wilson, 64, consultant and …merly chief engineer of the Pitometer … died at his home in Upper Mont-…r, N. J., on March 31. A graduate …he University of Maine, he worked … construction of the Panama Canal … then engaged in waterworks engi-…ring. He was with the Pitometer Co. … 30 years.

…rge H. Wood, 84, one of the West's …neer railroad builders, died March 31 … Oakland, Cal. Mr. Wood assisted in …ilding the Southern Pacific line from …akland to New Orleans in 1879, and … 1883 was one of the engineers who …ped build the Canadian Pacific's line … Yale, B. C.

…lan Corson, 66, former chief engineer … the Fairmount Park Commission, …hiladelphia, Pa., who was largely re-…sponsible for the development of several …hiladelphia parks and the construction … the Philadelphia Museum of Art and … Benjamin Franklin Memorial Park-…y, died April 4 in Bryn Mawr, Pa.

William A. Carlson, 49, who for 25 …ars had served as a construction super-…intendent for leading building organiza-…ions, died March 10. Mr. Carlson had …en associated with the George A. Fuller …., Turner Construction Co. and the …. K. Ferguson Co. He was a graduate … Cornell University.

John Byron Goldsborough, 79, chair-…an of the board of the Underpinning & Foundation Co., New York, and engineer in charge of the construction of several New York subways and the Croton Dam of the New York watershed, died at Croton-on-Hudson, N. Y., March 26.

Ernest F. Niemann, 66, Watertown, Wis., one of Wisconsin's best known county highway leaders, died March 14. He had served for more than 30 years as a member of the Jefferson county board.

CONTRACTS AND CAPITAL

CIVIL ENGINEERING construction in continental U. S. for the week totals $93,841,000. This volume, not including the construction by military combat engineers, American contracts outside the country, and shipbuilding, is 53 percent above the preceding week, but declines 62 percent from the corresponding week last year.

Private construction is 17 percent lower than last week, and 13 percent below last year. Public construction tops a week ago by 75 percent as both state and municipal work and federal volume increased. The public total, however, is 65 percent below the 1942 week.

The current week's volume brings 1943 construction to $994,271,000, an average of $71,019,000 for each of the fourteen weeks of the year. On the weekly average basis, 1943 volume is 55 percent lower than the $2,346,568,000 reported for the fifteen-week period last year. Private work, $108,467,000, is 46 percent below a year ago, and public construction, $885,804,000, is down 55 percent when adjusted for the difference in the number of weeks.

In the classified construction groups, gains over last week are in industrial and public buildings, earthwork and drainage, streets and roads, and unclassified construction. Commercial building is the only class of work to gain over the 1942 week.

New capital for construction purposes for the week totals $402,783,000. It is made up of $400,350,000 in federal appropriations for naval construction, $1,388,000 in state and municipal bond sales, $1,000,000 in corporate security issues, and $45,000 in government loans to municipalities.

The week's new financing brings 1943 volume to $466,888,000 for the fourteen-weeks, a figure that compares with $2,432,151,000 for the fifteen-week period in 1942.

CONTRACTS
Continental U. S. Only
(Thousands of dollars)

	Week Ending Apr. 9 1942	Apr. 1 1943	Apr. 8 1943
Federal	$210,344	$42,587	$76,090
State & Municipal	22,228	4,350	5,778
Total public	$232,572	$46,937	$81,868
Total private	13,772	14,452	11,973
TOTAL	$246,344	$61,389	$93,841
Cumulative 1943 (14 weeks)			$994,271
1942 (15 weeks)			$2,346,568

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1942 15 weeks	1943 14 weeks
NON FEDERAL	$207,196	$66,538
Corp. Securities	70,810	2,250
State & Mun.	113,072	59,655
R F C. loans	23,314	1,500
FPHA loans		3,133
FEDERAL	$2,224,955	$400,350
TOTAL CAPITAL	$2,432,151	$466,888

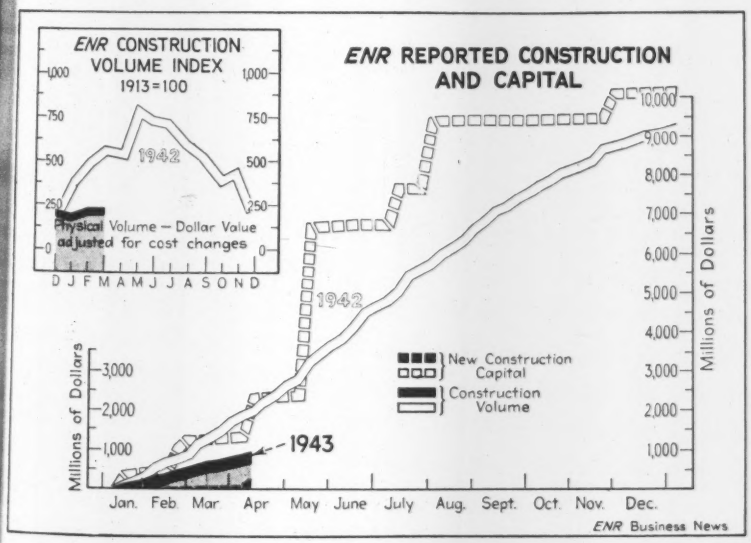
ENR INDEX NUMBERS
Index Base = 100

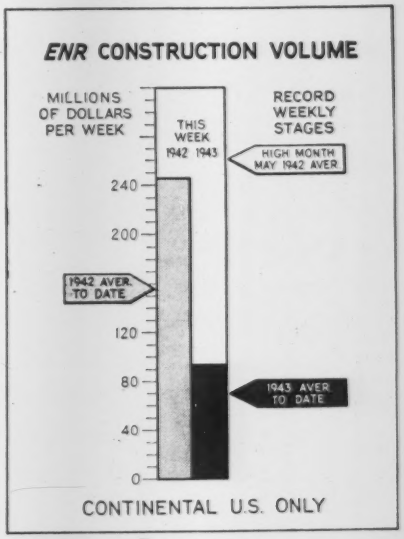
		1913	1926
Construction Cost	Apr. '43	288.80	138.83
Building Cost	Apr. '43	227.50	122.98
Volume	Mar. '43	228	100

FHA MORTGAGES

	Week Ending Mar. 28 1942	Mar. 20 1943	Mar. 27 1943
Selected for Appraisal			
Title II	$17,613	$5,714	.... *
Title VI	$36,327	$11,356	.... *

* No further data available.


ENR CONSTRUCTION VOLUME INDEX
1913=100
1942
Physical Volume — Dollar Value adjusted for cost changes
D J F M A M J J A S O N D
ENR REPORTED CONSTRUCTION AND CAPITAL
1942
1943
New Construction Capital
Construction Volume
Millions of Dollars
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
ENR Business News



Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Federal or Local Work Relief: An Administrator's View

SIR—In your issue of February 11, 1943, Arthur Richards, Engineer-Executive, Larchmont, N. Y. made some statements in a letter to the editor in which he compares the local control of work relief with federal control. It may be pertinent, as explaining Mr. Richards' viewpoint to point out that the village of Larchmont (population 5970) was never interested in operating WPA projects and indeed sought unsuccessfully to enjoin the Town of Mamaroneck, in which Larchmont is situated, from taxing Larchmont residents for WPA projects that the Town undertook.

Mr. Richards claims the main effect of WPA or any such administration is its pernicious political control. If Mr. Richards knew anything at all about this program, he would know that every person working on these projects, with the exception of necessary non-certified supervision, was referred to this administration by the local public welfare departments.

Control of assignments

The only control this administration had over the assignment of these persons was to refuse to accept them if in our opinion they were not able to perform the work, and also to refuse to accept them if investigation showed they were not entitled to relief. May I say that this administration found many persons not entitled to relief, and we were able to give public welfare departments much valuable information for their records. In making a charge that politics were used in making these assignments, Mr. Richards is making the charge, whether he knows it or not, against the Welfare Department of the Town of Mamaroneck and the County of Westchester.

Mr. Richards goes on to state that past experience definitely shows that local jurisdictions have performed more effectively on their own than under federal control. I would like to know where he gets any information of such effectiveness. Mr. Richards has never contacted this administration in reference to costs, and I am positive he does not have the cost of the former Work Relief Bureaus.

In New York we had a work relief program operated just as Mr. Richards would like to have it. This administration made some comparisons of costs of which the following in Table I may be cited.

The above is a state comparison, but we can get nearer home for Mr. Richards by giving a comparison in his own county. In Westchester County there were five local work relief bureaus, one each in Westchester County, Mt. Vernon, New Rochelle, White Plains and Yonkers. WPA, however, was set up on a district basis. This district included the Counties of Dutchess, Orange, Putnam, Rockland and Westchester. Under the local work relief setup there were fourteen different bureaus. Under WPA there was one central office with small branch offices in various counties. The comparatives are given in Tables II and III.

It will be noted that WPA administrative staff is 12.5% of the administrative staff and WPA ministrative staff cost is 15.2 E.W.B. administrative staff. (A significant comparison may be as shown in Table IV.

I want it expressly understood I am making no criticism of the ministration of the local work bureaus in Westchester County. I sonally was executive director work bureau in Albany County, exactly the same difference existed tween the costs under local and the costs under federal

We hear a great deal about local control but I do not believe any one advocating it has any ception of the difference in cost sane person must realize that tral administration is much less

I notice further in this same 11, issue a letter from Arthur Consoer, of Consoer, Townsend Quinlan, Chicago, Ill., in which makes a recommendation that if is to be a postwar WPA, the of WPA should demand in every that the sponsors provide adequate engineering services. I am very interested in this criticism, and think it is very sound.

TABLE I—EMERGENCY WORK BUREAU—WORK PROJECTS ADMINISTRATION

	ADMINISTRATIVE		SUPERVISORY		Relief Workers
	Employees	Cost	Employees	Cost	
E.W.B., October, 1934	3012	$340,417.44	9420	$834,207.67	87.5%
W.P.A., March, 1939	531	62,581.62	2143	270,765.00	64.7%

TABLE II—EMERGENCY WORK BUREAU—OCTOBER 1934

	ADMINISTRATIVE		SUPERVISORY		Relief Workers
	Employees	Cost	Employees	Cost	
Dutchess Co.	37	$4,755.83	17	$2,041.00	
Beacon	7	840.67	22	2,241.95	
Poughkeepsie	21	2,411.07	19	2,552.33	
Orange Co.	28	3,570.67	43	4,468.54	
Middletown	5	728.00	7	495.73	
Newburgh	22	2,652.00	36	3,679.69	
Pt. Jervis	17	1,772.33	79	7,459.48	
Putnam County	8	1,018.33	99	5,795.40	
Rockland Co.	24	2,626.00	56	4,787.03	
Westchester Co.	98	12,674.78	503	53,064.65	
Mt. Vernon	33	3,890.77	200	19,680.05	
New Rochelle	19	2,847.00	158	17,847.70	
White Plains	30	3,521.27	0	.....	
Yonkers	42	5,279.73	264	27,212.50	
TOTAL	391	$48,588.45	1,503	$151,326.50	

TABLE III—WORK PROJECTS ADMINISTRATION—AUGUST 1940

	ADMINISTRATIVE		SUPERVISORY		Relief Workers
	Employees	Cost	Employees	Cost	
Dutchess Co.			18	$1,694.31	
Orange Co.			43	5,510.79	
Putnam Co.	49	$7,333.00	2	143.22	
Rockland Co.			16	1,557.69	
Westchester Co.			208	24,109.04	
TOTAL	49	$7,333.00	287	$33,015.05	

TABLE IV—COMPARISONS IN E.W.B. AND WPA COSTS

	E.W.B. (1934)	WPA (1940)
...age Monthly Supervisory Wage	$100.68	$115.03
...age Monthly Wage of Relief Worker	57.93	59.03
... of Supervision per Relief Worker	11.66	5.81
...ber of Relief Workers per Supervisory Employee	9	20

The up-state New York WPA administration from the beginning refused to prepare any plans for two reasons—first, they did not believe they should operate a project on plans prepared by the operating agency, and second, they believed that private engineers and architects were entitled to this work. On all projects requiring plans, we insisted that either the city engineers prepare them or that the sponsors provide engineers or architects.

And in February, 1940, a survey showed that consultants had received a minimum of 169 commissions, receiving in fees approximately 1 million dollars; during the succeeding three years these commissions were probably more than doubled.

What officials think

I am very glad, so far as this administration is concerned, to state that the public officials of up-state New York as a rule do not feel the way either Mr. Richards or you do in reference to WPA. We have received a number of letters from public officials since the announcement was made that WPA was being liquidated. And in all of these letters they expressed a regret that the program is being terminated.

From the beginning, this administration believed we could only interest communities in projects where their own money was involved, and we endeavored to show them the benefits they could obtain. Local contributions, and these are actual and not simply paper contributions, amounted to approximately 40%. Certainly I do not believe public officials would have made any such contributions unless they believed they were getting value for their money. I believe if Mr. Richards had prevailed upon his community to contribute to the program, he would have had much more of an interest in it.

In conclusion I might cite some statements of Benjamin L. Smith of the well-known consulting firm of Whitman, Requardt & Smith. This firm were engineers for the new Albany water supply. After the supply was completed, a WPA project was suggested for building Basin C as an adjunct to Basins A and B of the Loudonville Reservoir, and this firm was also retained for this work. The city desired assurance that the construction of the new basin would be advanced enough so as to protect the construction during the winter. Mr. Smith states "For a project costing approximately one and a quarter million dollars, the performance of this amount of work during the construction season of 1936 would require greater progress than was attained in the building of the original basins." And, he further states "The rate of placing of concrete by the forces of the WPA was 33% greater than the corresponding rate on the construction of Basins A and B." And again, "Destitute men were taken from the humiliating futility of relief and were permitted to take a part in this contribution to the city's future welfare. Of secondary importance is the cost to the City of Albany, which was no greater than would have been the burden of providing home relief."

Other testimony available

I realize that one project should not be taken as an example but I submit this as the testimony of one of the most prominent engineering firms in the country. And, I submit further that this project was operated in the beginning of WPA before we had real experience. The same testimony can be given on hundreds of other projects.

In this I am not attempting to convince anyone who does not care to be convinced. I have been a business man and a banker and I feel content in the knowledge that WPA in up-state New York made a great contribution to the communities and at the same time provided work and a living for thousands of persons who were unable to obtain this from private industry.

LESTER W. HERZOG,
Administrator Works Projects Administration of New York State
Albany, N. Y.

Smoky Mt. Park Road to be a Postwar Project

Sir: The following statement appears in *ENR*, Dec. 24, p. 878: "The Tennessee Valley Authority has announced plans to acquire 40,000 acres of North Carolina land to expand the Great Smoky Mountains National Park, and to build a $3,000,000 highway through the scenic area."

We believe that readers received the impression that the Authority plans to spend $3,000,000 to construct the highway in addition to acquiring 40,000 acres of land to add to the park.

But the facts are quite different and entirely contrary in principle. The Authority is acquiring the land to avoid the present use of critical materials and manpower required in construction of a replacement of the section of the existing highway which will be inundated by Fontana reservoir. It is proposed that the highway will be constructed by the National Park Service after the war when funds for that purpose are made available by Congress. Ownership of the land involved makes it unnecessary to build and maintain roads for access and is the economical procedure.

MAURICE HENLE,
Chief, Information Service Staff
Tennessee Valley Authority

South American Waterway

Sir: In my article, "Inland Waterway for South America" (*ENR* March 11, 1943, p. 360), the phrase, "In the early '90s . . ." which appears in the third paragraph, should read. "In the early *1900s* . . .". Also the latitude of Manaos is given, in the article, as 30 deg. South; it should read 3 deg. South.

Actually the port works at Manaos were carried out from 1903 to 1907 inclusive; during the "early '90s" Manaos was merely a tiny frontier settlement and was then known as Barra.

If my memory serves me correctly, the Amazon was thrown open to international navigation in 1824, two years after Brazil became independent of Portugal, which indicates that its importance as a possible international highway was recognized even at that early date.

CHARLES JAY SEIBERT
Washington, D. C.

EDITORIALS

VOLUME 130 NUMBER 14

April 8, 1943

Calling All Construction Men

BIGGEST CONSTRUCTION NEWS out of Washington last week was the announcement by the Corps of Engineers of a plan to enlist 9,000 specialists a month, until further notice. Specialist, in this instance, means a man skilled in construction, so that the announcement puts real meaning into the often loosely-used expression "Construction goes to war." Any construction man over 18 is eligible, draftee or not, and the candidate, if physically fit, can join any one of the three Engineer Corps branches—Combat Engineers, Aviation Engineers or Special Service Engineers. Few men who enlisted with the Army Engineers in the last war ever regretted their choice. Those who enlist this time will have even greater reason to feel they are in the right service, for this is more of a construction war than the last one.

A Limited Supply

PLANS FOR MEETING Army and Navy needs for technical men without stripping war industries do not yet appear to be clicking properly. Army and Navy programs for meeting their own needs for specially trained commissioned and non-commissioned officers, by giving special training to some of the young men who are drafted, are taking concrete form in our colleges and universities. The Navy's program is getting under way faster, since it is less varied than the Army plan and since its scholastic work is similar to the normal courses in schools where it is being taught. Also, Navy personnel are kept in school or are sent directly to school, while Army trainees are given a 13-week basic training course in advance of the college training. Yet while the Army, Navy and Manpower Commission are thus striving to meet military needs by training potential engineers, the Selective Service continues to snatch real engineers from war industries to put them behind a gun or into a tank. For example, a graduate aeronautical engineer with four years practical experience in one of the big plants building war planes is drafted and put to doing "squads right." Surely his place in the Army could be filled by some young man left in a less essential industry. War industries need specially trained engineers just as much as the military services, yet the Selective Service continues to act as though the supply of properly trained engineers is unlimited.

Technical Books

THE GROWING IMPORTANCE of technical books in the war effort is shown not only by the increased number of such books published, but also by the special sections devoted to reviews of technical books now found in the weekly book review sections of Sunday newspapers. Of special interest to civil engineers is the fact that one of the first if not the first of these sections to be inaugurated is edited by a civil engineer, Dean Linton E. Grinter, of the Illinois Institute of Technology, for the *Chicago Sun*. It is to be hoped that the practice will outlive the war, as a distinct service can be rendered to the general public by authoritive comment on new books of technical and scientific interest.

Precast Structural Members

JUST AS PREASSEMBLY has speeded shipbuilding and prefabrication has accelerated erection of war housing, the concrete frames for industrial buildings in the Pittsburgh area are being constructed at fast time through the expedient of precasting members for the frames at a central yard. This substitution of precast concrete for the more conventional steel framing not only results in a large saving of steel when economy in steel is essential to the war effort, but points to the possibility that precast concrete will become a keen competitor for steel in the construction of simple frames where repetition of a few units makes precasting practical. In some other war structures of recent construction, precast concrete beams were substituted for timber in floor construction. Thus again, an expedient adopted to meet material shortages growing out of war activity may affect construction practice long after the war is over.

Now More Than Ever

STUDENT GUIDANCE, as is widely conducted in secondary schools by local units of the Founder Societies under the auspices of the Engineers Council for Professional Development, is of vastly more value now to boys considering engineering as a future career than it ever was in more peaceful times, even though most of those boys will be

Army or Navy before many months have ed. Except for the probability of military ice, the future is full of uncertainty for these . Hence the special need for advice from ure engineers who can view present conditions ectively. It can be pointed out, for example, the maximum amount of training in the fun- entals of engineering will be an asset to any in the military service that lies directly ahead. ell as in the postwar period when he takes up his interrupted scholastic training. And just as the war has brought new problems to the students, it has placed new demands on those who undertake to advise and guide students in planning their future in engineering. Advisers should be able to answer questions on selecting a branch of military service, and also should be able to project a boy's thinking into the future to show in what way one or another type of service can be an asset in attaining postwar engineering goals. Thus, it will be possible to render a real contribution to these boys now and for the future.

TACKLE FIRST THINGS FIRST

THIS SPACE in the March 25 issue postwar plan- was discussed as a mode of present action in trast to one of talk and debate. It was main- ed that postwar public works, for a given city state or federal department could be designed without waiting for the ultimate and perfect all national plan to be developed. But it was cognized that the change in emphasis from gen- l planning to the designing of specific projects not devoid of difficulties and obstacles. In a oad sense, the first of these obstacles is lack of ds for the designing work, but even more funda- tal is the frequent lack of legal rights to make propriation of the funds possible. If first things to be first, and they must be if postive action postwar planning is to result, the initial step st be taken by legislative bodies—Congress, te legislatures and city councils.

Too often this step is being overlooked by well- aning proponents of postwar public works plan- g. For example, at a recent meeting of munici- l engineers, the principal speaker of the evening thralled his listeners with an address on the vir- s of planning for the future. When he finished, charm and logic had conspired to convince most everyone that Postwar Planning involved more difficulties than turning a crank and watch- the projects appear. It seemed almost irrever- , therefore, to have the spell broken by one of the ss-enthralled engineers who asked, "How am I go about getting the money to make plans and ecifications for improvements in my town?"

Utterly bewildered by this practical turn of vents, the speaker allowed that he did not have answer, and waved aside such mundane considerations by saying that "Washington" might do something. The questioner's final retort was, "I've got to tackle first things first, and if my town is unable to advance funds because of legal restrictions, then I can't do much with postwar planning."

This incident served to dramatize a situation that is common throughout the country. State and municipal public works engineers, on whom will fall major responsibility for initiating action on postwar plans, can do little until the way is cleared to secure funds for designs and specifications. With few exceptions, legal hurdles exist that prevent inclusion of such funds in the capital budget, or prohibit quick revision of the budget once it has been adopted.

A realistic approach to postwar planning commands attention to "first things first." And one of the first things a state or municipality must do—if it is sincerely interested in preparing for the postwar period—is to determine how local funds can be advanced for such work. The Council of State Governors, this week, began a series of meetings whose objective is said to be the development of a postwar program that will assure quick action on public works planning. No better result could come from these meetings than the determination to enact or revise state laws that serve as obstacles to accumulating funds for extensive design work. The Conference of Mayors might also attack the problem on its level. And, of course, there is the need for engineers and construction men, who see the problem so clearly at first hand, to push necessary legal reforms at every opportunity. Design funds are needed now. Removal of restrictive laws is a first step toward making the funds available.

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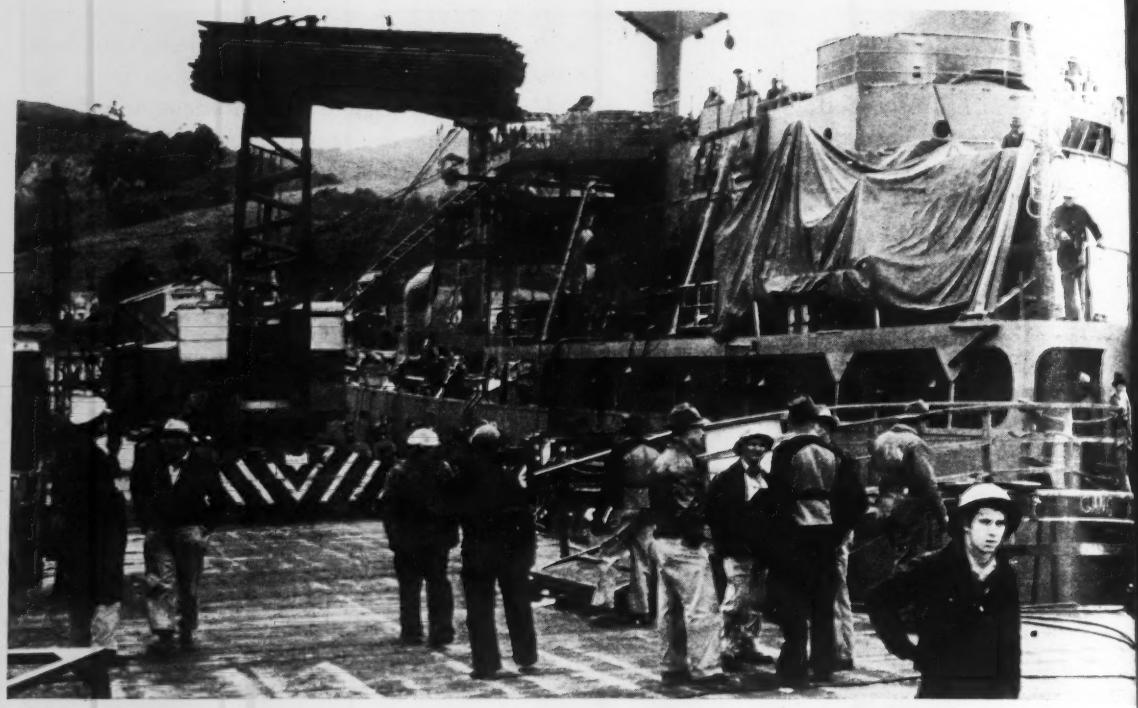


Fig. 1. On this high-level outfitting dock, man-hours are saved by having supplies and light cranes at level of ship decks

Shipyard Adopts Deck-High Outfitting Dock

***Contents in Brief**—Marinship Corp. in California, laid out after prefabrication methods of ship construction had been well developed in other yards, has outfitting docks 73 ft. wide, whose decks are built up to the level of ship decks and are made accessible to trucks by 5-percent ramps. An increasing amount of prefabrication, under roof, plus special attention to welding at this yard, are permitting increased speed in shipbuilding.*

LATEST IDEAS in shipyard design for maximum use of prefabrication methods characterize Marinship, a six-way yard built under a high-speed construction program at Sausalito, Calif. Yard construction started in March, 1942 and the first EC-2 ship was launched only 182 days later, despite the fact that an unusual amount of work had to be done in preparing the site. Relocation of a railroad was the first requirement, followed by the excavation of 1,000,000 cu.yd. of earth and rock and the driving of some 29,000 piles, practically all of which had to be long enough to develop the necessary bearing value by skin friction. Another item in the construction program was a 3,300,000-cu.yd. dredging job that was required to provide the necessary access channel and turning basin facilities.

Part of the site was a deep mud swamp; and it was necessary to use piling for all of the launching ways. Piles of the necessary length were not obtainable and splices of the sleeve and dowel type were used. To supplement the few creosoted piles that could be had, backfill was placed around much of the untreated piling, thus reducing the number of piles that had to resist exposure to marine borders.

An inshore portion of the yard was formerly a residential district where a rocky ridge extended down to the bay. It was here that most of the dry excavation was required; the excavated material was used for fill over a considerable portion of the yard area.

Marinship was planned after there had been considerable experience with prefabrication methods employed in other yards, notably at Calship in southern California (*Engineering News-Record*, Jan. 28, 1943, p. 38), operated by the same interests for many months before Marinship was laid out. The layout of the new yard, therefore, could take advantage of actual experience with prefabrication methods.

The results of this are notable in the provision of (1) much more space than most yards have for prefabrication and other yard operations, (2) large storehouse facilities at the end of the yard opposite the outfitting docks, (3) wide roadways to expedite transfer of equipment and materials and (4) a high-level outfitting dock, which eliminates the need for revolving gantry cranes. The advantage of these features is demonstrated to some extent by the fact that despite yard construction interference, the first EC-2 vessel was built with the expenditure of considerably less than one million man-hours.

Under a sawtooth roof, oriented that the roof windows bring in ght from the north, a 225x430-ft. assembly or prefabrication build- is arranged in six bays 70 and ft. wide. There is clearance of ut 40 ft. under the crane hook ive of the bays and of about 50 in one high bay where the larger s are turned over to increase the ount of downhand welding.

Prefabrication advances

t each end of the six bays in the fabricating shop, the cranes were nded 40 or 50 ft. beyond the ding limits to facilitate pickup naterials at the incoming end and ore finished assemblies at the out- g end. The length of such ex- ions, Marinship officials point should not be less than 50 ft. ond the building limits.

prefabrication scheme that has n developed effectively in this shop the complete assembly of hatches d deck sections, into single, 40-ton ieces. In this operation the 20-30-ft. atch, 5 ft. high, is first put together and welded. The hatch is then placed, right side up, on jacks with space on either side for the adjoining wing or deck sections. The hatch and the two joining wings make up into a sec- on with an overall width equalling the full 57-ft. beam of the deck and a length fore-and-aft of 30 ft.

The wings that go to either side of the hatch are first laid out upside down. In this position there is the advantage that the automatic welding machine can make the deck beam welds. Each wing is then turned over separately and is welded in place beside the hatch right side up. To give this three-part assembly sufficient rigidity to withstand lifting strains, temporary ties consisting of 8-in. I-beams, 16 ft. long, are used at the four corners of the hatch. One end of each beam is fastened at a corner of the hatch and the outer end is attached by a 1-in. bolt (held by a cotter pin) to the otherwise unsupported outer edge of the wing section. This saves building scaffolding. Before lifting, corner braces are put in the hatches and the outer edges of the deck section are trimmed off if necessary. The tie beams are painted a bright yellow to distinguish them from steel that is to remain in the ship. Ties are returned to the shop after the section is in the vessel.

This assembly plan is used on both upper and second decks. The improvement over the method previously used, when totaled for the five hatches in each deck, makes it possible to complete the upper deck prefabrication in about 10 days' less welding time than was previously required. On the second deck about 5 days' time is saved. Practically the only difference in preassembling for the two decks is that the second deck requires no jigs, the pieces simply being laid out on the flat.

In each bay of the plate and subassembly shops are cranes of capacities equal to the largest units to be handled. The yard is served by revolving type gantries with a capacity of 50 tons, while the gantries between the ways have 15-ton capacities. Where heavy assemblies are to be moved any distance, heavy trailers on rubber tires are used to great advantage.

High-level outfitting dock

A major feature in Marinship yard design is the high level of decks at the outfitting docks. These decks, on a level with decks of the ship being outfitted (about 31 ft. above M.L.L.W.) reduce by about 20 ft. the usual lift from dock to ship. With this arrangement, rubber-tired wagon cranes with a 20-ton capacity replace the large and more cumbersome revolving-type gantry cranes usually employed. Because the truck cranes are small and light as compared to the revolving-type gantries and do

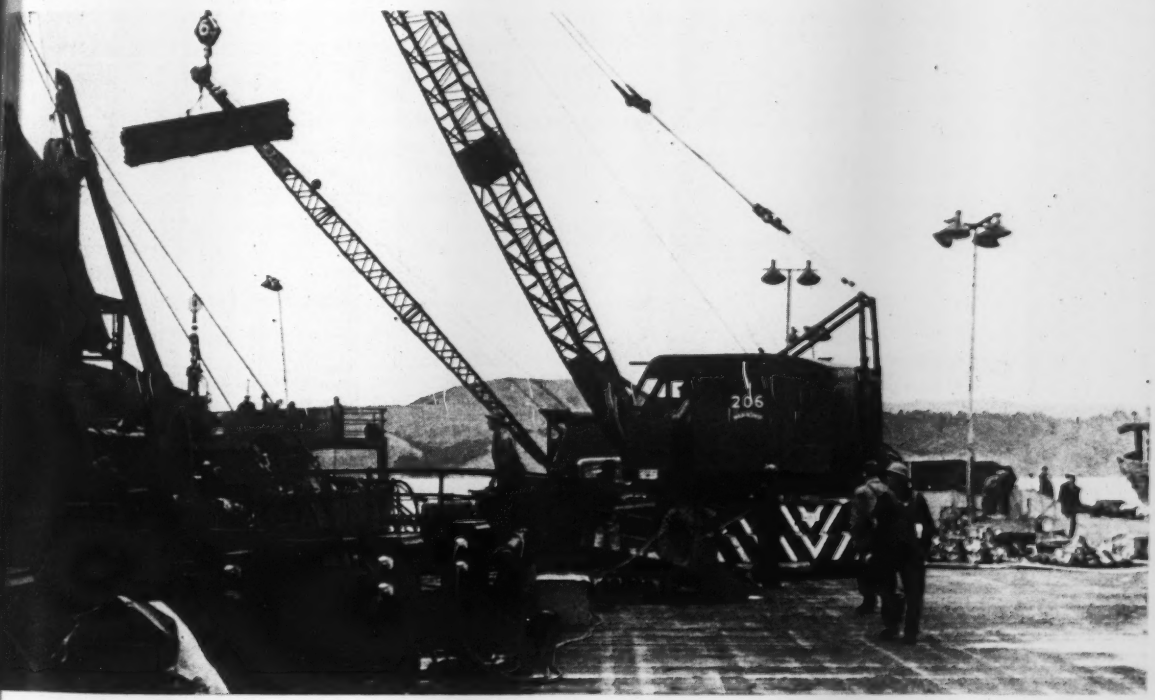


Fig. 2. Speed and flexibility of the service given by these rubber-tired cranes facilitates outfitting. High-level deck space, right, foreground, is kept clear for cranes.

Fig. 3. The nearer building encloses a 225x430-ft. area for prefabrication; beyond it is the plate shop. In foreground a part of prefabrication storage space.

not interfere, two or three may serve a single ship or they can be moved quickly from one high-level berth to another to help out where they are most needed. This gives flexibility and speed, materially shortening the time in all deliveries that require the use of cranes.

The high-level deck is reached from the yard level by a 5-percent ramp up which parts and materials are trucked as outfitting progress requires. The plan of operation is to provide the workmen, at high deck level, with everything needed in outfitting. On the deck are offices for those directing outfitting operations, tool rooms, toilets and storage space for small parts and materials. Trucks, lumber carriers or lift trucks are employed as required in deliveries, and for the heaviest parts, which rarely exceed 7 or 8 tons, the truck cranes move over to the inshore edge of the deck whence they can pick up loads from railroad flatcars on the track at yard level.

The plan is to have workmen go up to the outfitting deck when they go to work and not to leave that level until they go off. When workmen have to leave the ship to get tools or materials, it is not necessary to make the usual 20-ft. descent to dock level. Because of the large amount of time lost in going back and forth from dock level to ship deck by workmen engaged in outfitting, the high-level deck has been found to afford a very large saving in man-hours in addition to expediting material-handling.

Similarly, a considerable saving

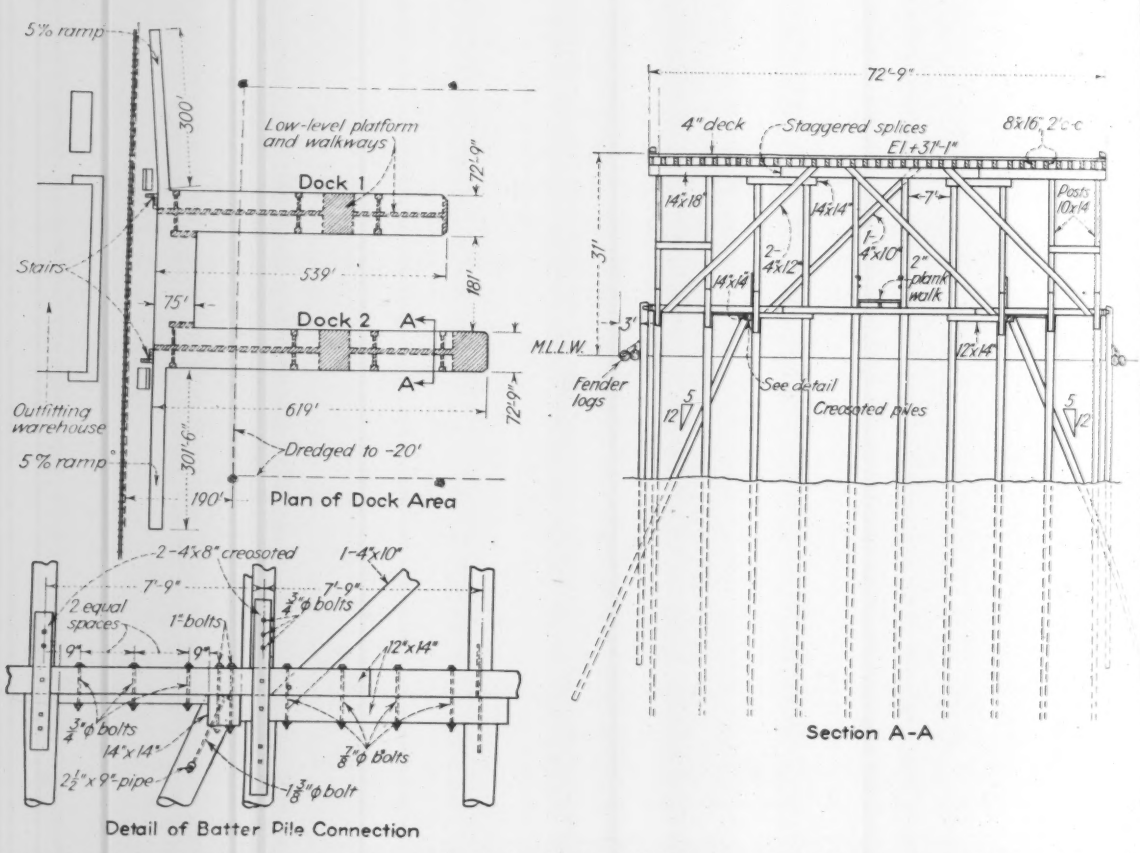


Fig. 4. Structural details of the outfitting dock, showing how the high-level work platforms are arranged and framed.

tility connections is effected by in-alling outlets at the high deck level. ese include lines supplying oxygen, ylene, electrical energy, com-ssed air and water. The closer con-tions greatly reduce the amount flexible pressure lines required that needed for low-level out-g decks.

he deck area on either side of the itting slip is 73 ft. wide and 464 long. This area is divided into thwise zones, each intended for ifferent use. The first 6 ft. on either storage space for welding machine roups, small parts, utility outlets, c. The next zone, 20 ft. wide, is crane operating area and is kept e from obstructions, as much as ssible, so that the cranes can move ely alongside the ship. The cen-al zone, about 20 ft. wide, is in-ded for truck operation and is d by trucks and other equipment king deliveries of equipment, ma-rials and small assemblies. Along edge of this truck zone, on either de, parts and materials may be piled nd left indefinitely if the piles are not over 6 or 7 ft. high, the height limit to permit free swinging of the crane counterweights.

The truck cranes for the most part have 16 wheels and for operation require a deck space of 16x24 ft. They have 95-ft. booms with capacity ratings from 2 tons at full boom to 15 tons at 20-ft. boom radius.

Below the high deck

Space in the outfitting dock beneath the high-level deck, i.e. at yard level, is not wasted. At the inshore end, which all workmen pass in going on and off shift, 500 lockers are provided for the storage of gloves, goggles, helmets and other small equipment that the individual worker might wish to leave on the job. A central walkway also is provided on the dock at yard level with laterals to the bollards and with ample deck width opposite the yard-level port leading into the ship's engine room. This port, usually about 5x7 ft. in size, is cut at a convenient point in the shell of the vessel while construction is in progress on the ways. The opening is temporarily welded up for launching and then is opened up for convenient access to the engine room during the outfitting period. A steel plate is welded into place in the opening before the vessel leaves the dock.

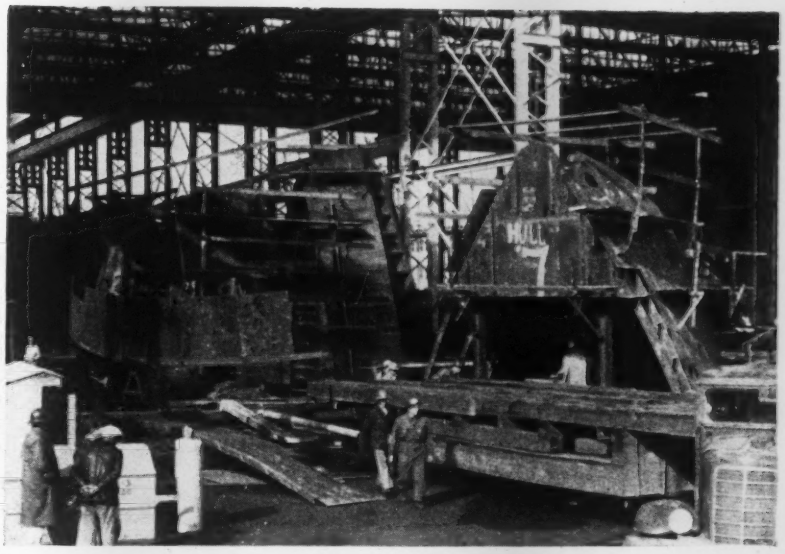


Fig. 5. Typical activity in the bay where after-peaks are assembled under traveling cranes.

The width of the usual log fender that is kept floating between ship and dock to prevent rubbing against the piling has been increased at this dock to a width of 3 ft. after rough water experience. Riding high and light, as the vessel does during outfitting, when fairly large swells come in, a vessel tends to roll enough to cause the side to strike against the high-level dock. With the 3-ft. width of floating fenderline, this trouble was obviated.

Despite the additional construction required for the high-level deck, if the cost of equipping the dock with cranes is taken into account, the high-level type is not more costly. The weight of the gantry ordinarily used in outfitting (about 60 tons) calls for heavier foundations, and this higher cost, plus the greater cost for the crane itself, offsets the cost of a higher superstructure with lighter cranes. When a single gantry has to stay in the dock center and serve ships on both sides of the dock, the usual dock width is 60 ft. The high-level outfitting dock escapes this width restriction because the smaller cranes can move close to the ship's side. Hence an extra 13 ft. of width was put in this high-level dock, thus increasing storage space and reducing congestion.

This greater width, also, increases stability of the high-level structure and its resistance to lateral force. The latter was still further increased by designing batter piles in the substructure for resisting uplift as well as the ordinary loading. These batter piles, put down from the second row of piling back of the dock edge, are inclined on a 5:12 slope and, by means of a $1\frac{3}{8}$-in. anchor bolt 3 ft. long, the pile's resistance to uplift is utilized. Fig. 4. This bolt is anchored in the pile by means of a short piece of $2\frac{1}{2}$-in. pipe inserted in a hole bored in the pile at right angles to the bolt. This pipe has, at its central point, two holes, drilled at right angles to the center line and of diameter sufficient for the anchor bolt to pass through. A nut to fit the anchor bolt is welded to the pipe at one of these holes. Thus when the anchor bolt is thrust down through the drill hole made for the purpose, its threads engage the nut in the pipe. Tension can then be put in the bolt to bring the pipe into bearing in the pile. This use of the batter piles to carry half the horizontal load in the form of uplift, was decided upon after a test on one of the batter piles showed that they were capable of resisting uplift.

Dock construction

The outer end of the outfitting dock is in 20 ft. of water underlaid by about 100 ft. of mud. Creosoted piles were used exclusively in the outfitting dock substructure, including the batter piles whose lengths ranged up to 120 ft.

An addition to the dock equipment which is now being considered is a stiffleg derrick (capacity about 50 tons) to be placed at the outer end for unloading freight from barges.

Fig. 6. Concrete deck at inshore end of ways gives a tight roof with minimum use of headroom.

TABLE 1. AN ESTIMATE OF WELDING ROD REQUIRED PER EC-2

Rod Size (inches)	Boiler & Sheet Metal Shop (pounds)	Plate Shop (pounds)	Pipe Shop (pounds)	Skids (pounds)	Ways (pounds)	Outfitting (pounds)	Total (pounds)
1/8 A.P.	1,000	1,000	3,400	1,000	1,000	1,000	8,400
1/8 Flat	1,000	.....	.....	.....	.....	.....	1,000
5/32	5,000	3,000	3,400	8,000	30,000	8,000	57,400
3/16 A.P.	.....	1,000	500	5,000	35,000	1,000	42,500
3/16 Flat	.....	2,600	.....	3,000	.....	.....	5,600
7/32 Flat	.....	5,000	.....	9,000	7,000	.....	21,000
1/4 Flat	.....	4,000	.....	10,000	7,000	.....	21,000
5/16 Flat	.....	2,000	.....	3,000	2,000	.....	7,000
Totals	7,000	18,600	7,300	39,000	82,000	10,000	163,900

TABLE 2. WELDING PERFORMANCE BREAKDOWN (HAND WELDING IN PLATE AND PREFABRICATION SHOPS, ON WAYS AND AT OUTFITTING DOCK)

Shift	Graveyard	Day	Swing	Total
Footage Welded	7,605	5,501	7,578	20,684
Production per man-hr.	1.449	1.399	1.552	4.440
Feet per man-hr.	5.25	4.00	4.88	4.70

(Automatic welding in shops, day shift only)

Footage welded .....3,013 Production per man-hr...106 Feet per man-hr.....28.4

It is thought that some freight might be more conveniently delivered by water than overland.

The superstructure of the outfitting dock is built of squared timbers carried on the caps of the creosoted pile foundation.

Welding operations

At this yard the policy is to handle as much production welding as possible on the graveyard shift. On that shift there are fewer interruptions and no interference from the numerous fitting crews that work only on the day and swing shifts. The advantage of this plan becomes apparent in the breakdown of welding figures for the three shifts as given in Table 2.

The welding work is so organized by the use of rotating supports for small assemblies, facilities for turning over prefabricated sections for most advantageous welding positions, etc., that 60 percent of all welding is now flat work. The endeavor is to increase the amount of hand welding, as compared to automatic welding, in the interest of speed. As this was written, the automatic welding amounted to less than 10 percent of the total. (As compared to 231,386 ft. of hand-welded seam per ship, the automatic welding now totals only 20,000 ft.).

In line with this policy there is extensive use of larger rods ($\frac{5}{16}$ in.) with which three passes can complete welds on the $\frac{3}{4}$-in. plates of the ship shell. Operati... with ... welding equipment, ...nner bott... sections of a vessel c... be placed ... hr. after the keel of th... ship has b... laid down.

No automatic weldi... is done ... the ways. Plates in t... bottom s... are tack-welded and a... quickly f... lowed by hand welder... using ... rods which work righ... through ... tack welds. A list of quantities ... different sized welding rods used ... this yard is given in Table 1.

The limitation on automatic we... ing is due to the time consumed ... getting automatic equipment to a... from special jobs, as on the wa... setting up work preparatory to t... welding, the necessary special fitti... and the final removal afterward. Co... stant effort is being made to increa... the footage per man-hour in ha... welding and this has been advan... to about 4.70 ft. as the average ... all shifts. The corresponding ave... age with the automatic machi... (which is extensively used in s... assembly) is about 20 ft. per ma... hour.

At this yard one leadman is ori... narily assigned to 8 welders (l... than half the number usually p... under one man) to secure higher ef... ciency. The policy is to train lea... men from the more capable men i... the crews, and the performance ... each man is watched with this ... mind.

It has been possible to encour... age the men and to reduce labo... turnover by having the foreman iss... cards that entitle the holders to wel... ing instruction at the In-Yard Train... ing School. This system is designe... not only for the men who are to b... trained for leadmen, but it afford... an opportunity to improve the per... formance of good men whose produc... tion is enough below standard to sug... gest the advisability of a little coach... ing.

Management and direction

The project started as the Mariti... Shipbuilding Division of the W. A... Bechtel Co. and the organization sub... sequently became the Marinship... Corp. The management includes K... K. Bechtel, president; W. E. Wast... general manager; Ray L. Hamilton... production manager; E. C. Panton... manager of construction; and Robert... Digges, administrative manager. Th... yard was designed by the Bechte... McCone-Parsons Corp., Los Angele...

Magnetic Nail Pickers Go to War

***ntents in Brief**—Nails and pieces of metal are removed from airfields d roads around camps and industrial plants in Texas with magnetic nail cker trucks operated by the state highway department, thus helping to nserve tires on planes, trucks and cars. This activity is supplementary to normal operations of the trucks, which cover 26,000 miles of the high- y system.*

AGNETIC NAIL PICKER trucks of the xas state highway department, ich normally operate over the 26,- 0-mile road system of the state, now ve been assigned to additional war- ne duties. Operating on airfields, mp and industrial sites, particularly er the completion of construction ork, they clean up nails and other eces of metal that would be a poten- l hazard to tires on planes, me- anized vehicles and trucks.

The two magnetic nail pickers de- gned and built by the department t only are performing an invaluable rvice in the conservation of tires d tubes, but they are making a con- ibution to the scrap metal salvage mpaign. More than 84 tons of nails, lts, nuts and other metal fragments ere gathered from highways dur- g the last two years. This year the ck-up will be greater than usual be- use of the special clean-up opera- ons at military and industrial estab- shments.

Method of operation

The magnetic pick-up device, which of the electric type, is suspended om the rear of a 1½-ton truck. Elec- icity is supplied from a 125-volt, 32 mpere, d-c generator, belt-driven om a 4-cylinder auxiliary gasoline ngine; both of these units are ounted on the truck along with the agnets. Only one man is required to erate both truck and magnet.

With the magnet in operation and spended about 4 in. from the round, the truck travels from 5 to 8 iles an hour. After the magnet has icked up a quantity of metal a canvas retcher is placed beneath it. When e current is turned off, the metal ieces fall on the canvas, thus permit- ng easy removal.

The electromagnet units, each of hich is 15 in., and 4 ft. long, consist of iron cases fitted with a wire coil and iron core. Two units are combined end-to-end so that when they are suspended from the truck they give a coverage on the road of 8 ft.

The case is a shallow box made with a piece of channel iron 15x2¼ in. outside dimension, and 4 ft. long; the ends are closed with ¼ in. iron plates welded in place. A brass plate, 15x$\frac{5}{16}$ in., is bolted across the open flanges thus completely inclosing the case.

After the case is made, the brass bottom plate is removed to insert the magnet. This consists of a grey iron core (36 in. long, 2 in. wide and 2¼ in. in depth, rounded on the ends)

Fig. 1. Traversing a newly built camp, the magnetic nail picker makes the road surfaces and parking areas safe for tires.

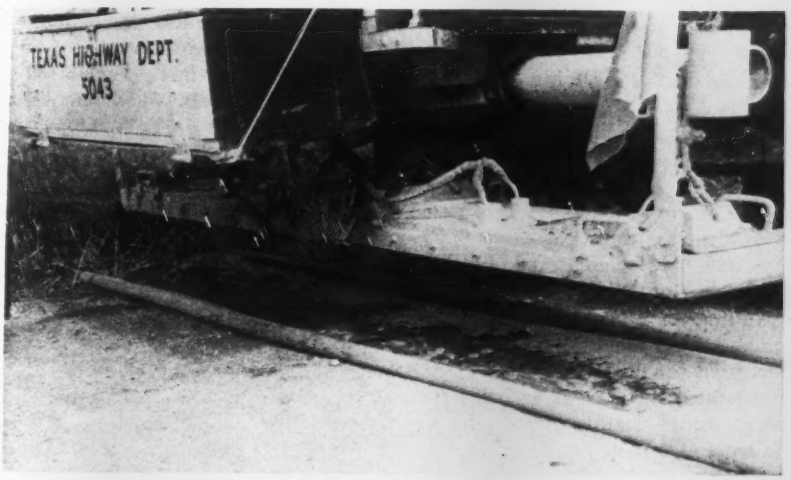


Fig. 2. Suspended from the rear of a 1½-ton truck are two electromagnets joined end-to-end so as to cover an 8 ft. strip of roadway. Under the magnet is a canvas stretcher upon which the metal fragments fall when the current is released. When operating, the magnets are lowered to within 4 in. of the road surface and the truck moves at a speed of 5 to 8 miles per hour.

around which is fitted a coil winding containing about 160 lb. of No. 8 square, fiberglass-insulated copper wire. The coil, made up of 362 turns of wire, is wound under tension over an oak core pattern, which is slightly oversize to allow for taping with $\frac{3}{8}$ in. strip linen. Taped tightly after winding, the coil is soaked thoroughly in varnish and then baked for 24 hours until hard and dry. This treatment forms the coil into a dense mass and prevents the turns of copper from shifting or loosening due to temperature changes.

After the coil is fitted over the iron core, the entire assembly is placed in the center of the box; cap screws through the ends of the box hold the wire-wound core in place.

Before the brass bottom plate is attached, a gasket of ebony asbestos of the same dimensions as the plate is fitted into place. The gasket serves to prevent moisture entering the case and also cushions the coil against mechanical shock. A light frame made of angle iron extends around the bottom of the magnet case to protect the edges of the brass plate and the screws that hold it in place from damage that might result in striking rocks and other obstructions.

Two magnets forming a single unit are suspended from the rear of the truck by means of an 8 ft. length of 4-in. pipe. The latter fits into drop hangers that are fastened to the truck frame, and the pipe is given enough play so that it can be rotated.

By means of a worm and gear arrangement the pipe can be rotated and thus raise and lower the magnet. The gear is in the center of the pipe, and the worm shaft extending through the floor of the truck, has a hand wheel to facilitate turning. A section of angle iron is welded about 6 in. from the ends of each magnet section, to which is attached a short length of heavy chain to form a V; the apex link of this chain is used to secure a $\frac{3}{8}$-in. piece of wire rope, which is secured to the pipe.

State highway department operations in Texas are carried out under the direction of DeWitt Greer, chief engineer. M. B. Hodges, maintenance engineer, supplied the pictures and data used in this article.

Pulled Piles Reveal Effectiveness of Asphalt-Treated Wrapping

Wartime shortages of creosote for treating piles has focused attention on other means of protecting untreated piling from marine borers. A much-discussed substitute on the West Coast is a protective coating of asphalt paint and roofing felt, sheathed with wood strips, extending from below the mud line to high water level. Recent removal of a considerable number of piles that were put down for temporary service at the San Francisco Bay Exposition has afforded an opportunity to examine such piles after service. Methods used in applying the treatment are described in the following.

Some 2,100 untreated Douglas Fir piles of lengths ranging from 58 to 102 ft., with a specified minimum butt diameter of 12 in. for vertical piles and 15 in. for batter piles, were used in constructing three passenger ferry slips and one freight ferry slip and approaches on "Treasure Island" in San Francisco Bay. Construction was completed in May, 1937. The contract price for the slips was $331,600. A separate contract was awarded for the protective coating of the piles in the amount of 55c. per lineal foot of treatment.

Unfortunately, exact foundations data were not available in advance and there was necessity for rather hard driving to get the required depth of penetration (so that the protective coating would extend down into the mud). This hard driving did some damage to the wooden battens. Where the protective coating was somewhat damaged or loosened by this means, the wood of the pile itself did not have the complete protection intended, and some deterioration resulted such as would not necessarily obtain where the advance control of lengths could be more effective. However, in general, these piles, when removed in 1941, showed that the protection had kept marine borers out of untreated piling which otherwise would probably have been entirely destroyed in this period of exposure. Most of the piles removed were suitable for redriving and were later put in service elsewhere.

The method of treatment was first to sun-dry the piles on skids and then to adz off all knots or other protruding irregularities within the area to receive the protective coating. The first coating was an application of heavy quick-drying asphalt pile paint with which a 10 percent (by volume) admixture of asphalt had been made. This coating was applied hot, with roofing mops.

Over this first coat was wrapped burlap impregnated with asphalt paint (roofing felt can be substituted for the burlap) fastened to the piles with galvanized roofing nails. These nails were spaced 5 in. apart, were 1 in. long, and had heads $\frac{9}{16}$ in. in diameter. A coating of hot roofing asphalt was then applied with mops as before. Then $\frac{1}{2}$x2-in. redwood bat-

Fig. 1. Placing the protective coatings on adzed pile surfaces.

…s were nailed on with 4-d. gal-…nized nails, the battens being …ced one against the other, com-…ely encircling the piles. Where …essary, battens were shaped to …form to the natural taper of the …es. Finally, another coat of hot …fing asphalt was applied and …owed to run into and fill any small …ces between the battens.

Specifications required that the …es be given the protective coating …r an average length of 22 ft., this …stance ranging from 4 ft. below …e mud line to 6 ft. above low-tide …el.

This protective coating was applied …a yard across the Bay from the …e. To prevent abrasion as the piles …ere being towed to the job, old …ires were placed around the piles …o prevent damage from contact in …e towing process.

In lifting the piles up into the …river leads, usual methods could be …mployed, with care, to avoid any …ontact that would abrade the bat-…ens. Driving with a steam hammer …as more effective than a drop ham-…er because of the tendency of the …atter to loosen the battens in hard …riving.

Method of application

Comment on the application of the …rotective coating has been made as …ollows: To get the maximum pene-…ration of the first coat it is important …hat the piles be quite dry before …pplication; the drier the better. …rimming is important because the …attens should be able to fit smoothly …ver the coated surface.

There was some difficulty in …tretching the impregnated burlap …ightly enough and unless care was …aken in this particular, it would be …kely to sag after the second coating …as applied. The nails used to fasten …e battens should be as long as pos-…ible without causing splitting; if …arbed nails could be used they would …robably improve the resistance of …e battens to loosening under the …mpact of driving.

There should be some leeway …ermitted in the length of the pile …o which the protective coating is …iven, thus making sure that the coat-…ng will be below the mud line on …iles that "bring up" a little sooner …han anticipated.

This general method of protective …reatment has been used to some ex-tent on San Francisco Bay for many years. Piles thus treated, taken from the Key Route mole after 30 years of service, are reported to have been in excellent condition.

Fig. 2. Nailing redwood battens over hot asphaltic paint.

Piles at the exposition were treated by Malott & Peterson, subcontractors under the Healy-Tibbitts Construction Co., who held the general contract for the ferry slips.

Intermunicipal Agreements Aid Wartime Water Service

Intermunicipal water service agreements, through which more than a score of large cities serve their suburban communities, are proving valuable in meeting various wartime problems, according to a survey by the International City Managers' Association.

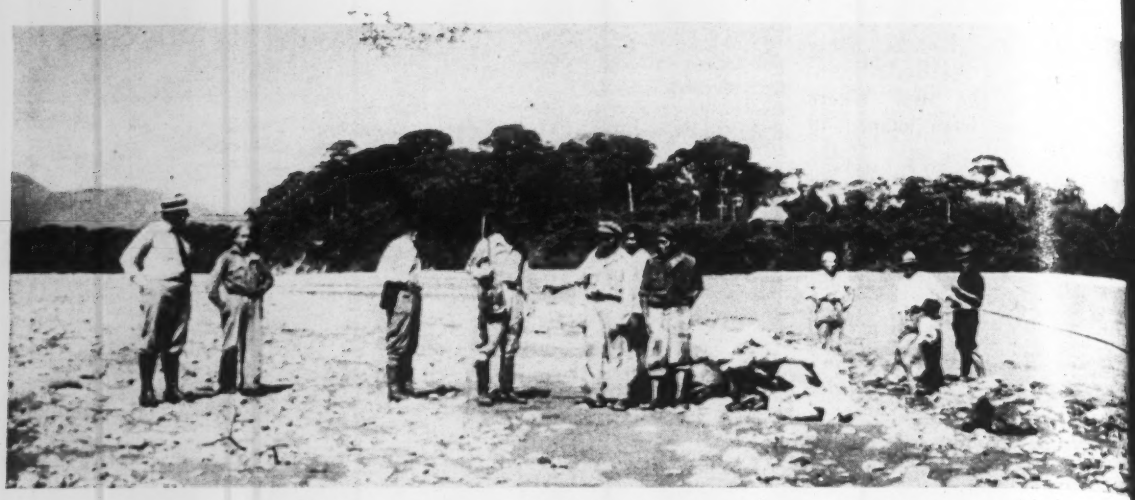
Cities throughout the entire state of New York recently banded together in war zones for mutual aid through interconnection of water systems and interchange of materials and personnel. Washington, D. C., is considering making interconnections with adjoining communities, establishing intercommunications systems between emergency repair groups, and exchanging equipment.

Most of the mutual arrangements of longer standing were made because the smaller communities had inadequate or unreliable water supplies, or because they were unable to construct treatment works themselves. In most cases the central city supplies the water to distribution systems owned and maintained by smaller neighboring communities.

The intermunicipal water agreements generally are set forth in written contracts or ordinances. Atlanta, Columbus, O., Cleveland and New York City charters authorize sale of water to neighbors, while Baltimore, Chicago and Providence are required by state law to furnish water to designated municipalities. In about one-half the 23 central cities surveyed the agreements are for indefinite periods; they are limited in the others.

Several kinds of "pay" arrangements are in force, according to the report. Chicago sells water directly to 27 municipalities and indirectly to 11 others, all within the Chicago sanitary district. Detroit, New York City and Portland, Ore., each has arrangements with 20 or more outside governmental units. Cleveland provides "master meter service" to Bedford, Cleveland Heights, East Cleveland and Lakewood, and direct service to 47 suburbs in addition.

Most cities report charges for the water service are adequate to meet cost; few have made profits. Mogadore, O., pays Akron a 5 percent surcharge in addition to the standard rate fixed by Akron for its own residents; Cincinnati charges 50 percent more for outside water rates and meter inspections; New York City charges rates varying according to watersheds supplying water. Rates in Portland, Ore., begin at 15 cents per 100 cubic feet of water at "gravity level" and are increased to almost double that amount where pumping is necessary.



Preparing to cross the Chapare River and plunge into the jungle to find a low-level highway route.

Highway Exploration in Bolivia

Harry P. Hart
Senior Structural Engineer, Public Roads Administration
Federal Works Agency, Washington, D. C.

***Contents in Brief**—Two engineers of the Public Roads Administration last year were appointed members of the United States Economic Mission to Bolivia to study the road needs of that country. With Bolivian engineers they explored possible routes for needed highways and made estimates of their cost. Because of the mountainous nature of part of Bolivia and the tropical conditions that are found in the remainder, the surveys were carried out under very difficult circumstances.*

EXPLORATION OF HIGHWAY routes in Bolivia was undertaken in 1942 by Edward A. Willis and the author, both engineers of the Public Roads Administration of the Federal Works Agency, as members of the United States Economic Mission to Bolivia. Assigned to these two members of the mission was the particular job of collaborating with officials of the highway department of the Bolivia government in studying existing roads and in planning roads needed for the economic development of the country. For seven months the two engineers, accompanied by Engineer Jose Gonzales of the Bolivian highway department, traveled hundreds of miles through the Andes on horseback, crossing over to the headwaters of the Amazon where they explored a tropical region on horseback, on foot and by dugout canoe.

Bolivia has three distinct regions: The highlands, a slightly rolling plateau known as the "Altiplano;" the lowlands, a large and only partly explored section, mostly jungle, overflowed for many months of the year, draining north and east of the Amazon, or east and south to the La Plata; and a canyon region between the Altiplano and the lowlands. The cities, mines, railroads and highways are concentrated mainly in a strip 100 to 250 miles wide and about 300 miles long lying in the Altiplano and canyon regions.

The more inhabited portion of Bolivia is a country of rugged mountains and deep canyons, lacking satisfactory means of communication, but with some roads and trails, hewed through the mountains as much as 400 years ago. A large, unsettled or sparsely settled region, tropical or semitropical in character, lies al... the headwaters of tributaries to ... Amazon River. This region is alm... wholly lacking in means of transp... except on the navigable portions ... the rivers. Since the navigable po... tions are in the more remote and u... settled part of the country, they do n... help to meet present transportati... problems.

Limited transport facilities

A railroad enters the country fr... the Pacific port of Antofagasta, Chil... and branches north to La Paz an... southeast to Argentina. La Paz is al... connected by rail with the seapo... at Arica, Chile. This railroad system ... (see map) with branches to Sucr... and to Cochabamba and for a sho... distance beyond, is the main arter... of communication within the cou... try. A limited mileage of highway ... supplements the railroad in giving ... communication to places off the ra... road.

Many of the roads are closed f... weeks and months by slides, wash... outs, high water and mud. Some ar... only one-way roads. Enthusiasm f... roads in Bolivia will be greatly i... creased when the people have had ... demonstration of the utility of ...

year two-way highway with easy
es and curves.

Highways badly needed

he greatest immediate interest is
uilding a 300-mile modern high-
from Cochabamba, at an eleva-
of nearly 8,500 ft., eastward to
a Cruz, elevation 1,400 ft., at
border of the tropical Amazon
on. The Santa Cruz area produces
er, hides, rice, sugar cane and
ical fruits. It has access to Bo-
n oil wells to the south and could,
out great difficulty, have access
n Amazon tributary to the north,
h is navigable by small boats.
ducts of the lowland region are
ded in the almost barren sections
the Altiplano and would be trans-
rted over the proposed road to
ochabamba, and from there by an
isting railroad to the Altiplano.

Limited supplies of commodities
ch as flour, machinery, potatoes,
uck tires and spare parts move east-
ard to Santa Cruz. Traffic on the
isting route is carried on under
reat difficulty. Movement from Co-
habamba is first by rail about 75
les to Vila Vila. From there a road
nds 280 miles over mountains and
rough canyons to Santa Cruz. From
to 20 trucks a day pass over the
d in each direction when it is open.
ides, washouts and mud close the
d for weeks at a time. These
sed periods total about four months
the year.

Trucks of 3-ton carrying capacity
used, with large single rear
heels, rather than duals, the theory
ing to reach down through the mud
solid soil. First class passengers
de in the cab, second class on top
the cargo; the latter have to get
t and push when necessary. The
p required about four days in good
ather and perhaps a month in bad.
night passengers sleep alongside
truck, and if it rains, underneath.
the road becomes unusable they
it for sunshine or a maintenance
ng.

Difficult exploration

In making their reconnaissance of
ssible highway routes the three en-
neers traveled little known trails
rough the Andes Mountains and
mazon jungles largely on horseback.
r each leg of a journey a local
an was engaged to provide saddle
nd pack animals, and act as guide,
cker and provisioner for the party.
Cooking utensils, bedding, a small emergency tent and emergency provisions were carried on pack animals. The guide purchased provisions along the way when possible and generally found a hut of some kind for the party to sleep in.

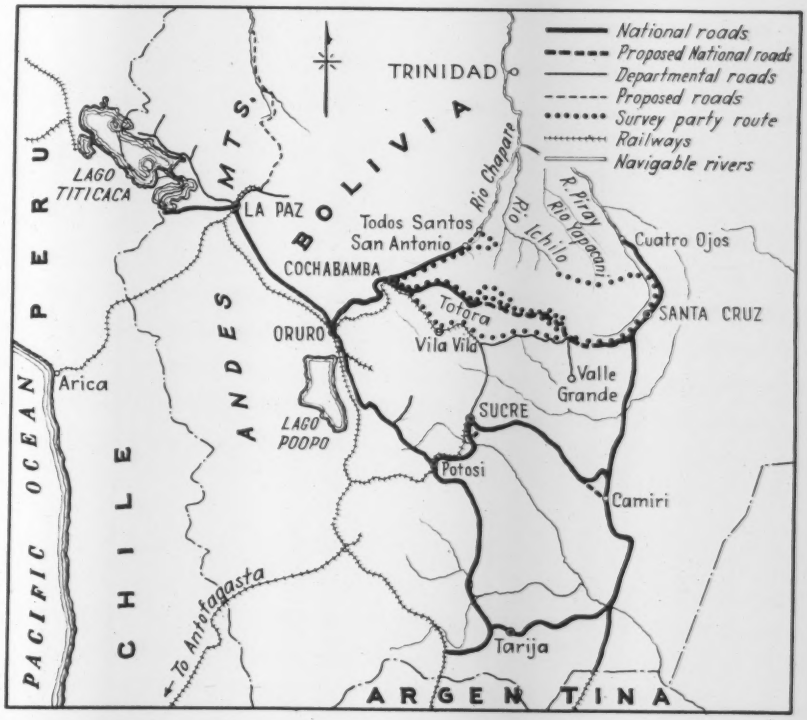
The guides turned out to be excellent provisioners, spurred on, no doubt, by self-interest in the meals provided. At one place the guide refused to pay 30c. each for chickens and bought a young goat for 5c. Contrary to all goat stories, this one provided excellent meat. Another delicacy, found along a tributary to the Amazon, was the "surubi," a fish about 3 ft. long, very similar to the Mississippi catfish. Oranges, bananas, pineapples, figs and other tropical fruits were plentiful in the lower regions wherever settlers were found.

Varied weather conditions

The survey was made during the rainy months of February, March and April, autumn in the southern hemisphere, but weather varied more with the elevation than with the months of the year. There were, however, regions of marked changes, for instance, at one camp on the eastern slope of the Andes the temperature dropped from 75 to 35 deg. in a few hours. Winds from the Amazon region had been warm and moist, but a change in weather brought cold raw winds from Argentina. At another camp in a streambed a tropical storm broke over the party during the night. In a terrific downpour, with lightning all around them, the entire party, engineers and peons, piled themselves together under a small tent fly. At daylight the guide suggested that it would be wise to move to higher ground. Just as the move was completed, a 3-ft. wall of water swept down the canyon and over the place where the party had slept.

Troubles were had from too little as well as too much water. One route to be explored was through a dry mountainous region with many dry streambeds. The party advanced without finding water. They dug to a depth of 15 ft. in a streambed but found no water. Two of the Bolivian helpers, suffering from thirst, had deserted the previous night so the party retired to its last water supply. Later a rain fell over the dry region and the exploration was completed without difficulty.

In their study of improving transportation facilities between Cocha-



Highways and railways of Bolivia. In seeking better highway routes from highlands at Cochabamba to the lowlands at Santa Cruz the survey party followed the routes shown as dotted lines.

On the existing road from Cochabamba to Santa Cruz a zig-zag location was followed at many points to avoid bluffs and sliding ground.

This section of the road over Mt. Ulluntije slid out, the slide extending far below the road. A new road is being built around the other side of the ridge.

The projected new road from Cochabamba to Santa Cruz will include this short section of completed road. It has a natural gravel surface.

bamba and Santa Cruz the engineers were anxious to investigate all possible routes so as not to overlook any bets. The first one investigated, called by them the "northern route" would require the shortest length of new road and would tie into the headwaters of the Amazon at points thought perhaps to be the head of future small-boat navigation. The first trip, therefore, took them northeast 120 miles over a narrow existing road across a high mountain range to San Antonio on the Chapare River. From there they attempted to strike southeast across the "llano" (fairly flat lowlands) to Santa Cruz. Only one party has ever been over the llano route for any distance. About 25 years ago the Major Nunez del Prado expedition of 50 men cut its way to the Ichilo River, a distance of 80 miles, requiring 48 days.

Engineers of the economic mission penetrated about 25 miles in three weeks of travel in the region, and then regretfully abandoned the idea of a route there because of difficulties that would be encountered in bridging numerous large rivers fed by an annual rainfall of 260 in. a year. Running from the lower slopes of the Andes at rapid, current is swift, and the broad channels do not lend themselves to easy bridging. These facts, coupled with the difficulties involved in widening the existing road over the mountains, led to abandonment of further consideration of the route at present.

At San Antonio a cableway supplied by the John A. Roebling Sons Co. is under construction across a tributary of the Chapare. This cableway will be used to transport loaded trucks, cattle and passengers. Twenty miles by mule on down the Chapare the town of Todos Santos is reached, the head of small boat navigation on that river.

Returning to Cochabamba, the party investigated a second route to Santa Cruz, called the Totora route. They found hidden out in remote places some very picturesque Spanish Colonial towns, with their narrow streets, bordered by low, wide-eaved, tile-roofed shops and homes. The severest traffic to which the ancient cobblestone pavement had been put was the pound of a pacing mule as her proud rider showed off her gait. These towns were located in a region of about 7,000-ft. altitude, of delightful climate and subtropic forests.

Some fine masonry bridges have been built on the Cochabamba-Santa Cruz road. This 100-ft. span arch is of sandstone masonry.

was hard to convince the hospitable townspeople that the party had to be on its way. It was considered highly inhospitable to procure new mules for the party too promptly.

The party also investigated the possibility of improving the road used at present for communication between Cochabamba and Santa Cruz, utilizing the 80-mile section of railroad already built from Cochabamba east to Vila Vila. However, long stretches of steepsided canyon were encountered and many long bridges would be required. The engineers were, therefore, unanimous in preferring the Totora route.

It was estimated that the 305 miles between Cochabamba and Santa Cruz, along the Totora route, can be built with permanent drainage structures, gravel base and plant-mix asphalt surfacing for $7,661,000. Gravel and stone are abundant along most of the route. Bolivian oils are of paraffin base and, therefore, unsuitable for road work. Asphaltic material can be imported from Peruvian fields.

A road of the type planned should greatly reduce transportation costs. In the wet season, hauling now costs 9½ cents (U. S.) per ton-mile compared with costs of 2½ to 4 cents per ton-mile in the United States.

Investigation was also made of possible feeder roads out from Santa Cruz. A new road south from near Santa Cruz, 185 miles to Camiri, would replace an existing poor road with sandy stream crossings, the graveyard of many trucks. This connection is desired to give access to developed oil fields at Camiri and to the south. Cost of this road was estimated at $1,704,000.

From Santa Cruz a route was investigated north 80 miles to Cuatro Ojos at the head of navigation on the Piray River, a tributary of the Amazon. It is estimated that this route can be improved for $726,000.

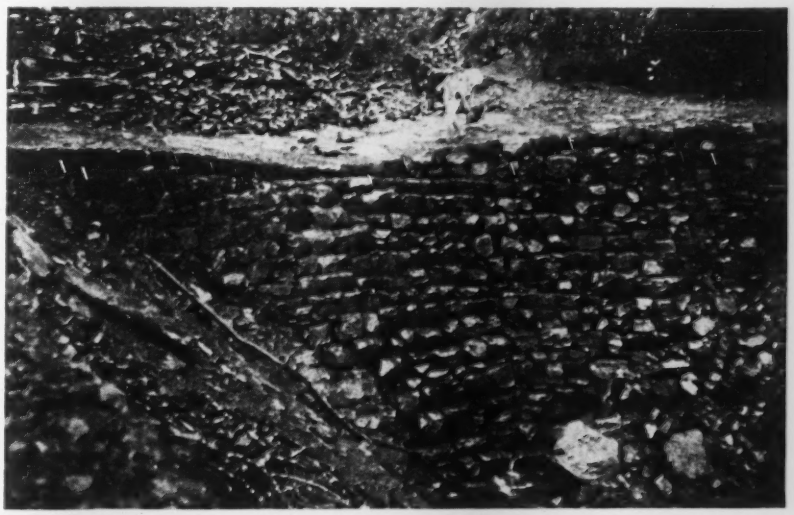
A general study was made of the other principal routes of Bolivia and recommendations made to guide the future development of a national highway system, working in collaboration with Bolivian engineers.

The conclusions reached by the members of the Economic Mission, of which Mr. Willis and the author formed a part, and of the Bolivian engineers associated with them, was that the Cochabamba-Santa Cruz road was most urgent, and that the Totora route was the most suitable route. The necessity for continuing the present betterment and maintenance program on the essential links in the national network was also pointed out, together with suggestions as to where surveys for alternate routes should be made.

A modern road from Cochabamba to Santa Cruz with extensions north and south, aggregating about 570 miles of new road, will make an enormous difference in the internal economy of Bolivia. Great improvements can be made by construction of other roads, but no other roads can produce the immediate results of these connections between the rich mining region of the Altiplano, the highway productive agricultural region of the lowlands, the oil fields of Camiri, and the waterways of the Amazon basin.

At present the entire Bolivian economy rests on the state of the tin market. Bolivia is now the principal source of tin for the United Nations. There are no substitutes for tin. Bolivia is doing her part to sustain and increase production. The United States government has reciprocated by entering into an agreement to continue tin purchases even if the war were to end tomorrow. In order to bridge Bolivia over a future period when tin production may fall off, and make sources of food production available, the road program was recommended.

It is necessary for Bolivia to bring food, gasoline, and many other ordinary commodities in from foreign countries, paying high transportation costs. This is due to the almost complete lack of all-weather roads connecting the populated areas with the productive areas. It is considered strategically important that the economic resources of the smaller South American countries be developed as their value as allies increases as they become self-sustaining.



A typical "dip" of the type used commonly, instead of a culvert at points where the runoff is so great that detritus would block a culvert.

How to Analyze Continuous Beams for Combined Dead and Live Loading

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Contents in Brief—A rapid procedure in using the Hardy Cross method in analyzing continuous beams for critical live loading plus dead load is outlined. How the method is applied is illustrated step by step for a 5-span design to obtain maximum positive and negative moments and maximum shears. Also described is a rapid method for preparing moment diagrams and obtaining points of inflection.

ALTHOUGH MOST ENGINEERS have little difficulty in analyzing continuous beams by the Hardy Cross method for dead loadings, this is not generally the case when critical live loading is involved. The latter case, while not necessarily difficult, is quite laborious. However, by a method now widely used by the U. S. Engineer Department this work can be systematized so that the various operatons become more or less routine and the entire analysis can be presented in a concise, tabulated form. The computations are based on loading the spans in such a way as to obtain maximum or minimum results. Since dead loads are always present, it follows that critical loading applies to live loads only.

In connection with critical loading four important principles must be remembered. They are:

(1) Maximum negative moment at any support is obtained by loading the spans on either side of the support, the remaining spans being loaded alternately.

(2) Maximum positive moment in a span will occur when that span is loaded and all other spans are loaded alternately.

(3) Minimum moment in a span is obtained by loading the spans on either side of that being investigated, while all other spans are loaded alternately.

(4) For maximum shear at any support the loading is the same as for maximum negative moment.

A complete analysis, as far as moments and shears are concerned, for a 5-span continuous beam is presented in Table 1. Essentially, the method consists in loading one span at a time and carrying the complete distribution out for each case on one line. This is the approximate method described on p. 176 of *Continuous Frames of Reinforced Concrete*, by Cross & Morgan, published by John Wiley & Sons, Inc., 1932 edition.

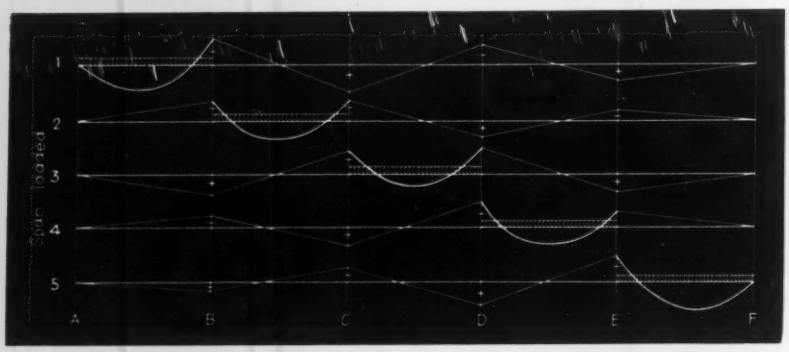


Fig. 1. Applying live load to one span at a time causes the moments shown above.

The moment conditions prevailing each case are shown graphically Fig. 1.

Referring to Table 1. Lines 1 are self-explanatory. In Line 6 the distribution factors: since the supports are considered hinged, stiffness factors $\left(\frac{I}{L}\right)$ of the spans must be multiplied by $\frac{3}{4}$ the distribution factors for supp B and E figured on that basis Line 7, the distribution factors a supports are interchanged for venience. This will be illustr later.

The fixed-end moments liste Line 8 are computed in the us manner and appear in all spans cept the end ones. The correction the fixed-end moments as shown Line 9 are obtained by multipl the fixed end moments in Line 8 the corresponding distribution fa tors of Line 6 and carrying over of the product to the opposite e of the span. Thus: $24.6 \times \frac{0.57}{2} =$ For the end spans, obviously means carrying over half of the fix end moment of the end suppor the interior support. If the end sp are loaded with uniform load, the sult is: $\frac{wL^2}{12} + 1/2 \times \frac{wL^2}{12} = \frac{wL^2}{8}$. In L 10, are shown the corrected fixed-e moments, which are simply the ad tions of the corresponding values Lines 8 and 9.

The operations just outlined a repeated for live loads in Lines 12 and 13. The distribution is carried out in Lines 14 to 18 inc sive, employing the distribution fa tors from Line 7. As stated befo each line represents a complete m ment analysis of the entire bea with one span only loaded. The co rected fixed-end moment each s of the loaded span is multiplied

corresponding distribution factor. The result is the negative moment at the support. This moment is then distributed to the next or preceding support, as the case may be, by multiplying one half of it by the distribution factor of the support to which it is carried and changing signs. This is repeated again for the following support and so on.

As is evident from Fig. 1, the moments to the right of the loaded spans are distributed to the right, while those on the left side of the spans are distributed to the left. Taking the first span as an example and referring to Table I and Fig. 1, the moment at the left support is zero. At the right support, the moment is $29.4 \times .52 = -15.3$.

Distributing to the right: $15.3 \times \frac{.43}{2} = +3.3$, and $3.3 \times \frac{0.4}{2} = -0.7$.

In like manner, when the third span, for instance, is loaded, the corrected fixed-end moment at the left support, from Line 10, is 47.8. The negative moment then is $47.8 \times .57 = -27.2$. Distributing to the left and changing sign: $27.2 \times \frac{.48}{2} = +6.5$ Likewise, at the right support $44.7 \times .4 = -17.9$. Distributing to the right and changing sign: $17.9 \times \frac{.36}{2} = 3.2$. Following the same simple procedure for the other spans, the distribution is completed and the results are ready to be totaled.

Since dead loads are always present in all spans, it is evident from Fig. 1 that the moments with their respective signs have to be added algebraically to obtain the moments at the supports. Thus, the dead-load moments on Line 19 are obtained. For the maximum live-load moments, the spans have to be loaded according to the Principle 1, stated previously. Considering support *C* for instance, the second, third and fifth spans will be loaded. The other spans are unloaded and are therefore disregarded.

An examination of Fig. 1 will reveal that these spans all have negative moments at *C*. If support *D* is considered, the loaded spans will be: 1, 3, and 4. Again, it is seen, that the loaded spans have negative moments at the support. It follows then that the maximum negative moments at the supports are obtained by adding together in Table I the negative quan-

TABLE 1. STEP-BY-STEP ANALYSIS OF 5-SPAN BEAM BY SIMPLIFIED APPLICATION OF HARDY CROSS METHOD

			1		2		3		4		5	
		A		B		C		D		E		F
1		Beam	B1		B2		B3		B4		B5	
2		Span	12 ft. 6 in.		15 ft. 8 in.		21 ft. 0 in.		14 ft. 0 in.		18 ft. 9 in.	
3		Size	14 x 24 in.		14 x 24 in.		14 x 24 in.		14 x 24 in.		14 x 24 in.	
4		D. L.	1.5 k. ft.		1.2 k. ft.		1.0 k. ft.		1.6 k. ft.		1.3 k. ft.	
5		L. L.	1.0 k. ft.		1.0 k. ft.		1.2 k. ft.		1.0 k. ft.		1.0 k. ft.	
6		D. F.	.48		.52	.57	.43	.60	.40	.64	.36	
7		I-D. F.	.52		.48	.43	.57	.40	.60	.36	.64	
8	D. L.	F. E. M.			24.6	24.6	36.8	36.8	26.1	26.1		
9	D. L.	Correction			7.0	6.4	11.0	7.9	8.4	5.2		
10	D. L.	Cor. F. E. M.	29.4		31.6	31.0	47.8	44.7	34.5	31.3	57.2	
11	L. L.	F. E. M.			20.4	20.4	44.1	44.1	16.3	16.3		
12	L. L.	Correction			5.8	5.3	13.2	9.5	5.2	3.3		
13	L. L.	Cor. F. E. M.	19.6		26.2	25.7	57.3	53.6	21.5	19.6	44.0	
			D. L.		L. L.	D. L.	L. L.	D. L.	L. L.	D. L.	L. L.	
14		1	−15.3		−10.2	+ 3.3	+ 2.2	− 0.7	− 0.4			
15		2	−15.1		−12.6	−13.3	−11.1	+ 2.7	+ 2.2	− 0.5	− 0.4	
16		3	+ 6.5		+ 7.8	−27.2	−32.6	−17.9	−21.4	+ 3.2	+ 3.9	
17		4	− 1.4		− 0.9	+ 5.9	+ 3.7	−20.7	−12.9	−11.3	− 7.0	
18		5	+ 0.7		+ 0.6	− 3.1	− 2.4	+11.0	+ 8.4	−36.6	−28.2	
19		− M	−24.6		−23.7	−34.4	−46.1	−25.6	−34.7	−45.2	−35.3	
20		Max. − M	−48.3		−80.5		−60.3		−80.8			
21		Max. + M	36.5		27.6		68.5		19.5		69.5	
22	D. L.	Vo	9.37	9.37	9.4	9.4	10.5	10.5	11.2	11.2	12.2	12.2
23	D. L.	ΔV	− 1.97	+ 1.97	− .6	+ .6	+ .42	− .42	− 1.4	+ 1.4	+ 2.4	− 2.4
24	D. L.	V	7.4	11.34	8.8	10.0	10.92	10.08	9.8	12.6	14.6	9.8
25	L. L.		0 →	23.7	23.7 ←	5.2	26.7 →	34.7	34.7 ←	3.1	24.3 →	0
26	L. L.		0 ←	1.8	4.2 →	46.1	46.1 ←	10.8	2.3 →	35.6	35.6 ←	0
27	L. L.	Vo	6.25	6.25	7.8	7.8	12.6	12.6	7.0	7.0	9.4	9.4
28	L. L.	ΔV	− .14	1.9	1.2	2.7	1.7	.4	2.3	2.4	1.9	− 1.3
29	L. L.	V	6.11	8.15	9.0	10.5	14.3	13.0	9.3	9.4	11.3	8.1
30		Total V	13.51	19.49	17.8	20.5	25.22	23.08	19.1	22.0	25.9	17.9

tities only. The total maximum moments at the supports in Line 20 are summations in each case of live and dead load moments.

Evaluating shear

The determination of shear for dead load is simple. The shears obtained from the simple-beam loading are increased or decreased by the increment of shear due to unequal moments at each end of the support. Referring to Fig. 2, it is clear that the shear increment $\Delta V = \frac{\Delta M}{L}$, and this quantity is added to the simple-beam shear at the side having the largest moment. The dead-load shears are thus computed in Lines 22, 23 and 24.

For maximum live-load shears the loading is as stated in Principle 3, which is also the loading for maximum moments at the supports. Hence, these moments are set down, to start with, criss-cross, at either side of the supports in Lines 25 and 26. The moments at the opposite end are then figured by picking out the moment values with their signs, corresponding to the negative moment values at the support under consideration.

Suppose the shear to the left of support *D* is desired. Spans 1, 3 and 4 would be loaded. The moment values at *C* corresponding to the negative moment values at *D* are: + 2.2, — 32.6, + 3.7, and the moment is — 26.7. For the maximum shear to the right of support *D* the loaded spans are the same as before, and the corresponding moment values at *E* are + 3.9, — 7.0. The moment at *E*, therefore, is — 3.1. The same procedure is followed to fill in the moment values at the remaining supports, in Lines 25 and 26. The signs do not have to be shown in this case, because normally the moment would be all negative.

Under certain conditions the moment at the opposite end of the span may turn out to be positive and would have to be so designated. In that case, the moments at the two sides of the span would be on opposite sides of the base line rather than above it, and would have to be added rather than subtracted from each other, in order to compute the moment increment. The arrows in Lines 25 and 26 are always pointed to the support that is being investigated, and the increment of shear is added to the simple beam shear of that support.

A somewhat different condition exists at the end supports, where the moment is zero. The shear increment obviously will have to be subtracted from the simple-beam shear and it should be a minimum quantity if the shear is to be a maximum. But since the shear increment is a function of the end moment, the end moment must be a minimum. This condition will exist when the end and alternate spans are loaded. Thus, if Spans 1, 3 and 5 are loaded, the moment at support *B* is: — 10.2 + 7.8 + .6 = — 1.8. At support *E*, the moment is: — 28.2 + 3.9 = — 24.3.

The remainder of the work shown in Line 27, 28, 29 is the same as for dead-load shears in Lines 22, 23 and 24. The total maximum shear in Line 30 is simply the summation of the corresponding dead- and live-load shears.

The maximum positive moments in Line 21, can be either computed or obtained from curves. Both methods will be explained below.

With uniform loading, the maximum moment in the end spans is simply $\frac{V^2}{2W}$ where V is the total shear at the end support and W is the dead and live load per lineal foot of span. Thus, in Span 1, $M = \frac{13.51^2}{2 \times 2.5} = 36.5$. Similarly in Span 5, $M = \frac{17.9^2}{2 \times 2.3} = 69.5$

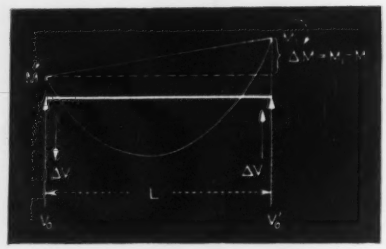


Fig. 2. To obtain the maximum shear, the shears obtained from the simple-beam loading are increased or decreased by the shear increment due to unequal moments at ends of span.

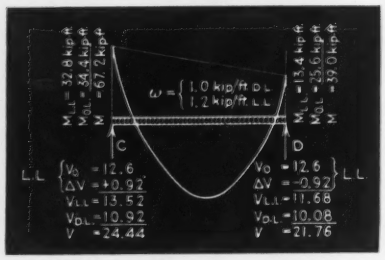


Fig. 3. Determination of shear for maximum moment in the middle span was as above.

The loading for maximum moment between supports is stated in Principle 2. Suppose the moment in Span 3 is desired. Spans 1, and 5 would be loaded; the other spans are unloaded and need not be considered. The negative moments at supports C and D are obtained from Table 1, and are, respectively, — 22.6 — 2.4 = — 22.8 and — 11.4 — 2.4 = —13.4. The increment of shear is $\frac{32.8 - 13.4}{21.0} = 0.92$, which is added to the simple-beam shear at C and subtracted from the simple-beam shear at D, as shown in Fig. 3. Adding the dead-load shears, the result is a total shear of 24.44 at C and 21.76 at D. The maximum moment is then $\frac{24.4^2}{2 \times 2.2}$ — 67.2 = 68.5, or figuring from the other end, $\frac{21.76^2}{2 \times 2.2}$ —39.0 = 68.5 as before.

The procedure is exactly the same for moments in the other spans. If the span is loaded with concentrated loads, the shears and the negative moments at the supports are obtained as explained above. The point of zero shear is then computed and the moment figured for that point by simple statics. This completes the analysis of the continuous beam for maximum shears and moments.

Points of inflection

Frequently, in designing beams, the points of inflection are required. These can be calculated from the information in Table 1. However, it is probably simpler to get them from the moment curves that are drawn for the beams being analyzed. These curves are very useful, also, because they furnish a comprehensive picture of moment conditions existing throughout the span of each beam. The magnitude of the moment at any point can be ascertained by scaling, and the reinforcing steel provided just where needed. The points of inflection are clearly defined and can be easily determined. The positive moments, as stated before, need not be calculated, but can be taken directly from the curves.

Assume that the maximum positive moment in Span 2 is desired. According to Principle 2, the second and fourth spans will be loaded. The live-load moments for the loading at *B* and *C* are, from Table 1, — 12.6, — 0.9 = — 13.5 and — 11.1 + 3.7 = — 7.4, respectively. Adding the dead

load moments of — 24.6 and — 34.4, the resulting combined negative moment at B is $-13.5-24.6=-38.1$ and $-7.4-34.4=-41.8$ at C. These moments are laid off to any convenient scale at their respective supports, above the base line, and a line is drawn joining the two points, as shown in Fig. 4. Since the span is loaded with live and dead load, a simple-beam moment parabola for the combined loading is "hung" from this line.

A simple and easy way of drawing the parabola is to divide the span into six equal parts by vertical lines. The ordinate for the simple-beam moment is then laid off on the middle vertical, from the line joining the two negative moments. On the second and third line from the middle, towards each support, ordinates equal to 8/9 and 5/9 of the simple-beam moment are laid off in the same manner. A smooth curve is next drawn through the points thus obtained. The part of the parabola below the base line forms the outline of the maximum positive moment curve under critical loading; points of intersection of this curve with base line are points of inflection.

The minimum moment in the span will occur when the loading is according to Principle 3. The loaded spans then are: the first, the third and the fifth. The live-load negative moments at the supports, from Table 1, are: $-10.2+7.8+0.6=-1.8$ at B and $+2.2-32.6-2.4=-32.8$ at C. Adding the dead-load moment as before, the total negative moments at B and C become $-1.8-24.6=-26.4$ and $-32.8-34.4=-67.2$ respectively. These moments are laid off at the supports above the base line, as before, and the points are joined by a line. A simple-beam moment parabola, due to dead load alone, is then suspended from this line, since the live load was omitted from the span. The curve is entirely above the base line, showing that negative moment prevails throughout the span in this case.

In order to obtain the complete outline of the maximum negative moment, separate half curves will be required for each support. For the maximum negative moment at B the loaded spans, according to Principle 1, must be the first, second and fourth. The negative live-load moment at B would naturally be — 23.7; at C the moments are obtained from Table 1. They are $+2.2-11.1+3.7=-5.2$; adding the dead-load moments, the result is $-23.7-24.6=-48.3$ and $-5.2-34.4=-39.6$ at B and C, respectively. The procedure from here on is the same as in the other case, only that one half of the simple-beam moment parabola for combined dead and live loading needs to be drawn in. Summation of maximum negative and positive moments from both dead and live load are shown in Table 2.

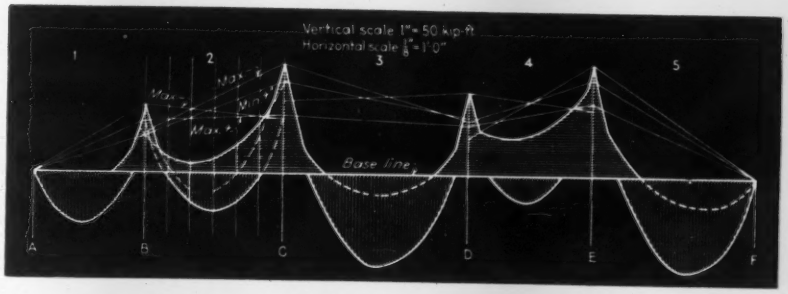


Fig. 4. Positive and negative moment conditions for all spans as determined by the author's description. The lines connect the points of negative moment at the supports from which the various moment parabolas are drawn for each span. Each parabola originates from a different line depending upon loading conditions.

The second half of the parabola is obtained by loading Spans 2, 3 and 5. The live load moment at C in this case is —46.1, and the corresponding moment at B is $-12.6+7.8+0.6=-4.2$. Again, adding the dead load moments the result is $-4.2-24.6=-28.8$ and $-46.1-34.4=-80.5$ at B and C, respectively. The simple beam moment parabola for live and dead loads is used, as in the previous case. The outline of the maximum negative moment under critical loading is now easily defined, as shown by the heavy line in Fig. 4.

The other spans are treated in like manner and the picture of the moment conditions in the beam is completed.

The procedure for concentrated loads is a little different. The outline of the moment curve is obtained, in this case, by computing the actual moments at a number of points along the beam. The number of points required depends upon each individual case. If, for instance, one heavy concentration only is present, and the uniform load is light, the only point required would be the moment under the concentrated load, and the moment curve will then be defined by straight lines, for all practical purposes. The actual moments are easily figured by the rules of statics once the shears and negative moments at the supports are computed.

The procedure outlined above is widely used in the structural design office of the U. S. Engineer Department and is found to be eminently satisfactory for design of continuous beams with critical loading.

TABLE 2—MOMENT VALUES AT SUPPORTS FOR DIFFERENT LOADINGS

Conditions of Loading			Span 1		Span 2		Span 3		Span 4		Span 5	
			Supports		Supports		Supports		Supports		Supports	
			A	B	B	C	C	D	D	E	F	F
Max. +		L. L.	0	1.8	13.5	7.4	32.8	13.4	10.7	7.4	24.3	0
		D. L.	0	24.6	24.6	34.4	34.4	25.6	25.6	45.2	45.2	0
		Total	0	26.4	38.1	41.8	67.2	39.0	36.3	52.6	69.5	0
Min. +		L. L.	0	13.5	1.8	32.8	7.4	10.7	13.4	24.3	7.4	0
		D. L.	0	24.6	24.6	34.4	34.4	25.6	25.6	45.2	45.2	0
		Total	0	38.1	26.4	67.2	41.8	36.3	39.0	69.5	52.6	0
Max. −	At left support	L. L.	0	0	23.7	5.2	46.1	10.8	34.7	3.1	35.6	0
		D. L.	0	0	24.6	34.4	34.4	25.6	25.6	45.2	45.2	0
		Total	0	0	48.3	39.6	80.5	36.4	60.3	48.3	80.8	0
	At right support	L. L.	0	23.7	4.2	46.1	26.7	34.7	2.3	35.6	0	0
		D. L.	0	24.6	24.6	34.4	34.4	25.6	25.6	45.2	0	0
		Total	0	48.3	28.8	80.5	61.1	60.3	27.9	80.8	0	0

Wood Imhoff Tanks Serve an Army Camp

***Contents in Brief**—Constructed entirely of wood, a battery of nine Imhoff-type settling tanks with a capacity of 3.8 mgd. are in use at an army sewage disposal plant. The design permitted the elimination of critical materials and resulted in speedy construction.*

CONSTRUCTED entirely of wood and with a capacity of 3.8 mgd. a battery of nine Imhoff-type settling tanks recently installed at an army cantonment may lay claim to distinction from the standpoint of both size and design. The tanks form part of a primary sewage treatment plant installation in which the objectives sought were the elimination of critical materials and mechanical equipment, as well as speed in construction.

Each tank in the battery is 15 ft. wide, 75 ft. long, 24.5 ft. in width, the battery covering an area of 137.5 by 75 ft. Framed and sheathed entirely with timber, and supplied with wood sluice gates and channels, the tanks are completely devoid of critical materials.

The design was developed by Elwyn E. Seelye, member of the New York consulting firm of Tuttle, Seelye, Place and Raymond. In discussing this installation, completion of which was required in a very short time, Mr. Seelye pointed out that it would be taken as long or longer to [illegible] forms for a concrete structure that did to complete the job with time

Designed on the basis of provid[illegible] a two hour detention period, [illegible] tank will accommodate an aver[illegible] flow of 0.42 mgd; the number tanks in use at any one time will course, be determined by the total ume of flow. Channels, flumes gates are so arranged that the through the tanks can be reverse order to accomplish even distribu of settled solids.

Gravity removal of sludge from hopper bottoms in the tanks is cured with the aid of a hydraulic

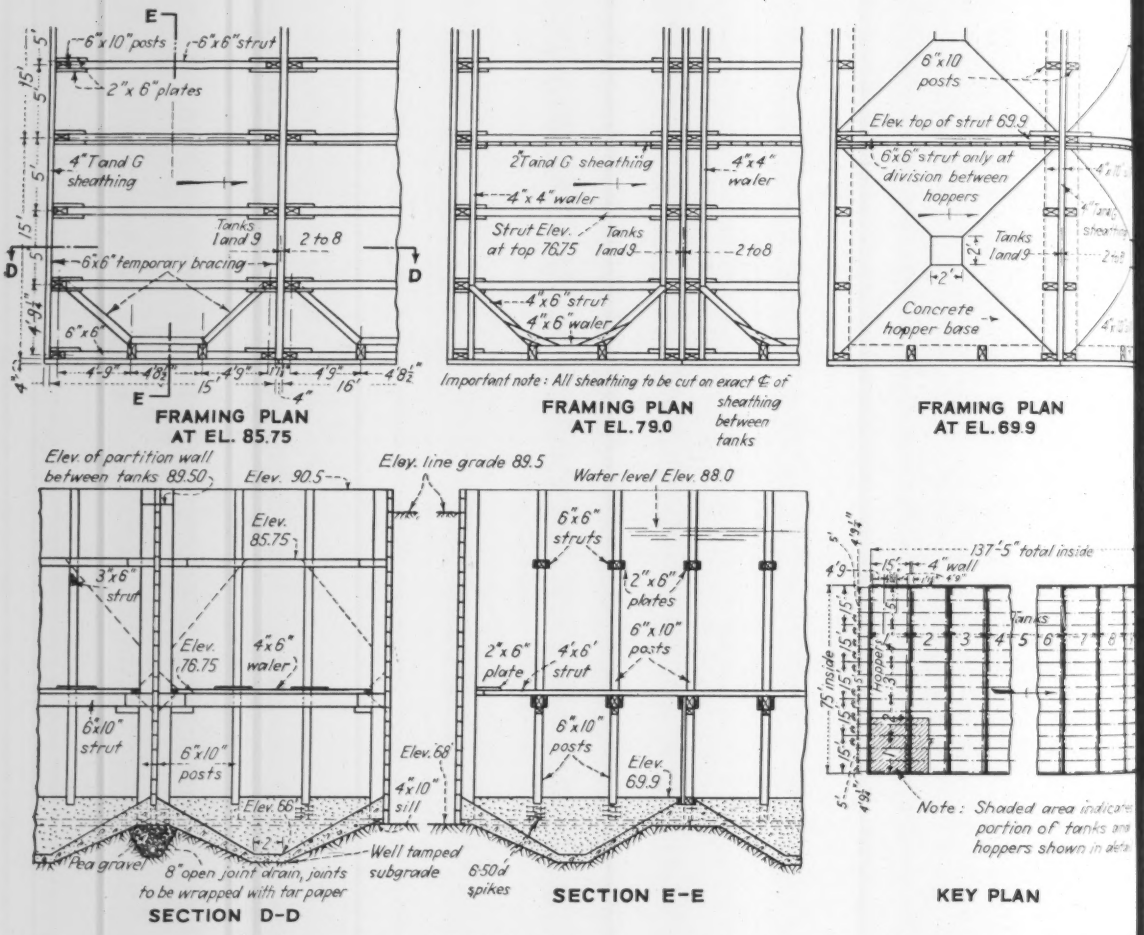


Fig. 1. Framing details of the wood Imhoff tanks. Exterior and and partition sheathing are 4-in. tongue-and-groove stock supported by two sets of interior bracing. All the wood is painted with creosote prior to installation.

6 to 7 ft. This head exists by virtue f the high elevation of the liquid el in the tank compared with the vation of the drying beds to which sludge is discharged.

Each of the nine tanks is provided th five sludge hoppers, and each pper has a wooden vertical riser e connected to horizontal wood es that run parallel to the length of tank. The riser pipes are gated so t sludge can be removed from any e or all of the hoppers. The hori- tal wooden pipes are connected to dge manholes which, in turn, are nected to each other and to the dge drying beds by means of cast n and vitrified tile pipe.

Factors affecting design

It was desired in making this de- gn to avoid the usual difficulties in e construction of Imhoff tanks due the subaqueous excavation and nsequent cofferdam construction in- lving pumping.

A gravity flow from the inlet sewer uld have fixed the depth of these nks at a point where their bottoms uld have been some 12 or 15 ft. low groundwater, which would have en not only undesirable from a con- uction standpoint, but would have sed a problem resulting from per- nent uplift on an empty tank. For is reason, the tank was raised to a int where a gravity drainage at the ttom level could be obtained. This cessitated construction of a siphon der an adjoining highway. This phon was built with twin pipes and blow-off pipe connected to a gravity ain so that the siphon could be eaned with ease.

By this method, the contractor was abled to construct the entire struc- re in the dry.

Raising the elevation of the tanks ought them about half way out of e ground, which resulted in a prob- m in supporting the exterior walls ainst outward hydraulic pressure. is was solved by placing an em- nkment around the tanks—particu- rly on the lower sides—the em- nkment being made of the spoil om the tank excavation.

Tension ties could have been used place of an embankment, but the olting required to develop the aces as tension ties would have ed considerable priority material, uld have slowed construction, and uld have required construction de- ils not altogether foolproof for the

Fig. 2. Partition walls and framing for the bottom section of a battery of nine wood Imhoff tanks. Each tank is 15x75x24.5 ft. in depth.

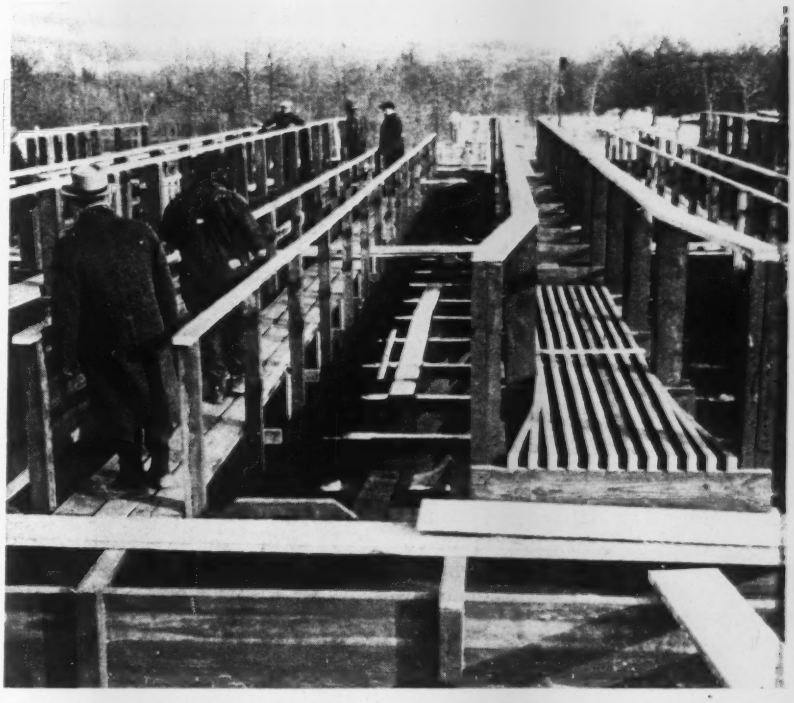


Fig. 3. Top of the completed tanks showing distribution channel (foreground) and the wood walkways.

labor available. Another factor was the desirability of having an embankment around the tank to prevent seepage that otherwise would cause objectionable conditions. Furthermore, elevating the tanks made it possible to drain the sludge to the beds by gravity.

The inward lateral pressure due to earth embankment pressure or unequal filling of the tanks will be resisted by two levels of horizontal braces. These horizontal braces are fitted between double struts 10 in. thick, as shown in Section D-D, of Fig. 1. The total timber thickness in one of these joints is 24 in., which makes nearly 10 ft. of wood subject to horizontal swelling and it was necessary to consider the effect of this swelling on the horizontal struts. This was taken care of by placing spikes between the ends of the horizontal struts and the vertical timbers so that

excessive pressure would cause the spikes to crush the wood fiber and thus provide a certain amount of play to take care of the swelling.

In order to expedite the work and prevent settlement, manholes and piping, where required, were placed on wooden trestles buried in the fill. While this expedited construction, such an arrangement probably would not be permissible if a longer life than five years were anticipated.

Complete installation, including Imhoff tanks, siphon, grit chambers, clarification chamber and control was $180,000, or about $50,000 per million gallons, which is believed to be considerably lower than similar costs obtained in concrete construction.

Construction procedure

The bottom of the tank site was shaped to provide for the sludge hoppers, each of which is about 15 ft. square. Paved with [illegible] concrete, the hoppers are slope-[illegible]ed and about 4 ft. deep in the center. Between each tank, open joint drains of 8 in. tile are laid to relieve hydrostatic uplift.

Fig. 4. Detail of the slot construction.

Complete details of the layout and framing are shown in Fig. 1. All the members used for framing were long leaf pine.

Sheathing for the exterior and partition walls consisted of [illegible] in. T. & G. stock, likewise of long leaf pine. Furnished in widths of 6, 8, 10 or 12 in., the sheathing was laid at right angles to the framing. All joints were made at the center line of posts.

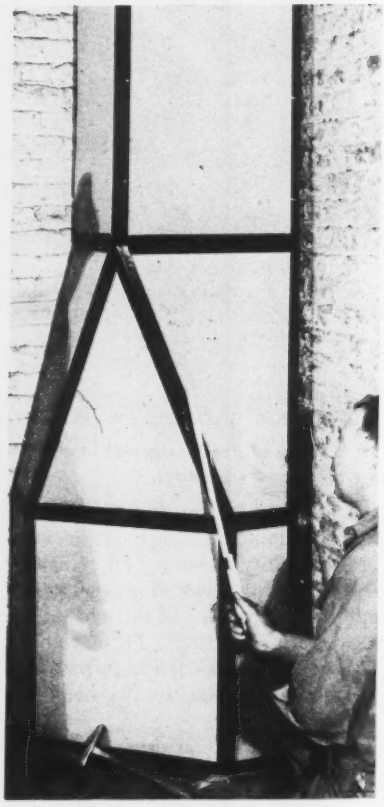
All lumber used in these structures was painted with one coat of creosote before being placed in its final position. The creosote conformed to federal specification PT-W-561A. It is believed that this treatment is sufficient to provide for a structural life period of five years.

Ducts of Non-metallic Sheets Used For Air Conditioning

Non-metallic sheet board ducts and casing are being used in air conditioning installations to save huge quantities of critical metal, according to T. M. Cunningham, construction manager of Carrier Corporation, Syracuse, New York. While the new sheet board does not entirely replace sheet steel, so great is its application that a recent duct system installation estimated at 300,000 lb. required only 66,000 lb. of sheet metal. Sheet boards were substituted for the remaining 234,000 lb.

Several factors must be considered in selecting a sheet metal substitute, namely, availability, ease of fabrication, strength and durability of finished duct or casing, rigidity of material, and surface resistance to air flow. In addition, the substitutes for sheet metal must have a hard, smooth finish, be non-hygroscopic, non-warping and non-inflammable. Preferably the material should be workable with tools usually used for sheet metal work.

Listing Asbestos Ductboard, Asbestocite, Apac ARA Board, Transite, Masonite and Hard Board as among the best known substitutes that meet these requirements, Mr. Cunningham said: "These boards and numerous others available, have several advantages over sheet metal used in ducts. They are more rigid so do not require the "cross-breaking" that is used in metal ducts. They have higher insulating value so the B.t.u. loss or gain is less than in sheet metal ducts."



A non-metallic duct in place.

From experience in using the metal substitutes it is believed that $\frac{3}{16}$-in. thick sheet board may be used throughout for some air conditioning systems, especially those ranging in size from 10,000 to 50,000 cfm. by using only one thickness for an entire duct system, fabrication costs are reduced and tooling problems are simplified, resulting in lower installation costs. In systems larger than 50,000 cfm, it is advisable to use 1 in. board to eliminate requirements for stiffening and other construction "extras."

The design of ducts made from sheet board is not different from those made of metal. The resistance to air flow of the sheet board duct is greater but not sufficiently different to make necessary a larger duct. Square vaned elbows, and other "fittings" may be made in sheet board ducts.

Supports for the sheet board duct can be the same as those used with sheet metal duct except that they may need to be heavier to support the greater weight.

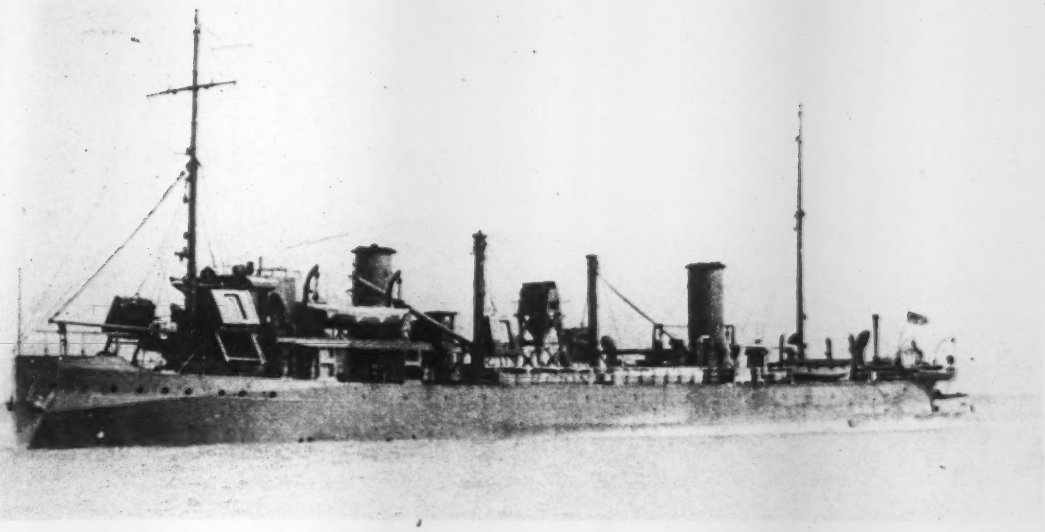


Fig. 1. Deep channel clearing in rough water is carried out by this sea-going suction hopper dredge.

Dredging Hard Material in Rough Water

Lieut. R. C. Jensen
(CEC), US Naval Reserve

***Contents in Brief**—Comparative volume and cost data are given for a suction and a sea-going ladder dredge excavating both hard and soft material in rough water. The ladder dredge, not common in American practice, cuts material that otherwise would have had to be blasted with mud caps. Considerable time and large quantities of explosives were saved by using the ladder dredge for the hard cutting.*

On ESSENTIAL HARBOR WORK the U. S. Navy recently was confronted with a problem of deepening and widening a channel that called for dredging equipment ordinarily not used in this country. Material to be moved varied from sand and clay to a hard calcareous rock, and handling was complicated by an exposed location with generally prevailing heavy swells and rough weather. These conditions precluded the use of standard American dredging equipment of the dipper, grab, or suction type as it was feared that dredges working on spuds would be impracticable.

The first plan considered for excavation was the use of a sea-going hopper suction dredge of the type used by the U. S. Engineering Department in its rivers and harbors improvement program, supplementing the dredge operations with blasting of the hard material. It was believed that such a dredge, equipped with a suitably heavy drag shoe, could remove the soft sand and clay and some of the softer calcareous material. Harder rock would have to be broken into small parts by underwater blasting to reduce it to a size that could be handled successfully by the suction dredge.

Conditions that precluded the use of dredges working on spuds also made it impractical to use a drill boat for blasting. The only other possibility was dobie blasting—placing a mud cap over an explosive charge laid on the rock without drilling. This is an uneconomical method at best, and under the conditions at this location, a very inaccurate one. It was estimated that at least 5 lb. of explosive would be needed for each cubic yard of material broken small enough to be removed by the suction dredge and that a total of 2,250,000 lb. of dynamite would be needed. The necessity for use of this amount of explosive material and the extra time involved in blasting operations made this procedure very undesirable and uneconomical.

The plan adopted was to use a self-propelled hopper suction dredge to remove the soft material and a sea-going ladder dredge to remove the hard material, or at least the major portion of it, thereby reducing the amount of blasting necessary to a negligible amount. The U. S. Engineer Department diverted from its fleet of sea-going hopper dredges, a vessel especially suited to this type of work. The unit had a 26-in. suction pump and a large, single center-drag equipped with a heavy shoe at the end of the drag pipe. The ship draws 20 ft. of water when loaded and requires a depth of at least 22 ft. for a width of 30 ft. on either side of the channel to sweep to its full capacity.

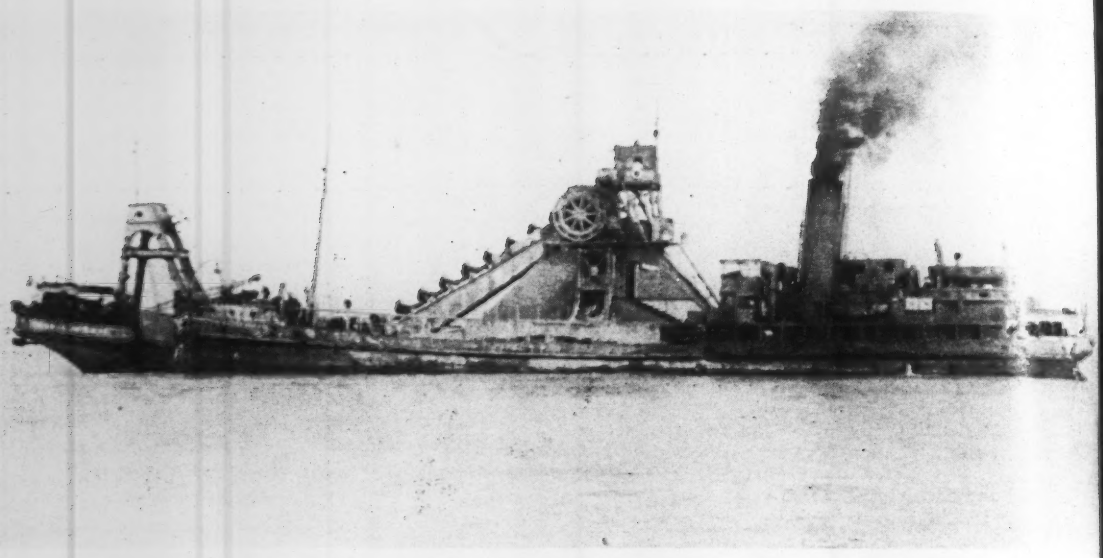


Fig. 2. The ladder dredge is loading a self-propelled hopper barge on the near side. The stacks are in line and the two ships are difficult to distinguish.

Only one dredge of the ladder type necessary for this work had ever been used in this country—the "Corozal" first used on the Panama Canal—but this ship was not available. A suitable dredge was found in a country adjacent to the work and was chartered with two self-propelled seagoing hopper barges as attending plant.

Sequence of operations

The project lent itself to the immediate utilization of both dredges. One end of the channel passed through a shallow reef, the material in which was hard. Beyond the reef and extending to the opposite end of the channel the bottom material consisted of sand and clay interspersed with patches of the hard calcareous rock. Further, there was ample depth of water on both sides of the channel in all but the reef section, for the suction hopper dredge to sweep the full width of the channel.

The ladder dredge started on the deepening and widening through the reef section while the suction dredge worked in the open-area of the channel, which contained a softer [illegible] more easily removed material. [illegible] patches of hard material, which [illegible] suction dredge could not remove were later cut down to the required grade by the ladder dredge.

While the ladder dredge is equipped with hoppers, they were not used. Instead the spoil was discharged through side chutes (Fig. 2) directly into self-propelled hopper barges that came alongside for this purpose. Except in the very roughest weather the barges were able to operate continuously. This method of handling [illegible] is obviously more economical than dumping into the dredge hoppers because the dredge spends all its time on the dredging operation. One of the self-propelled hopper barges accompanying this dredge as attending plant has a hopper capacity of [illegible] cu.yd. while the other has a capacity of 530 cu.yd.

The suction dredge was not designed to discharge directly into barges or scows alongside. Instead it discharged directly into its own hoppers and when full carried its load to nearby spoil areas. About 40 percent of the effective working time was lost in the dumping operation but, despite this, the hopper dredge performed its work very economically, as shown in the cost and production summary. Years of experience have enabled the U. S. Engineer Department to produce a dredge [illegible] designed for the work normally performed and the one assigned in this

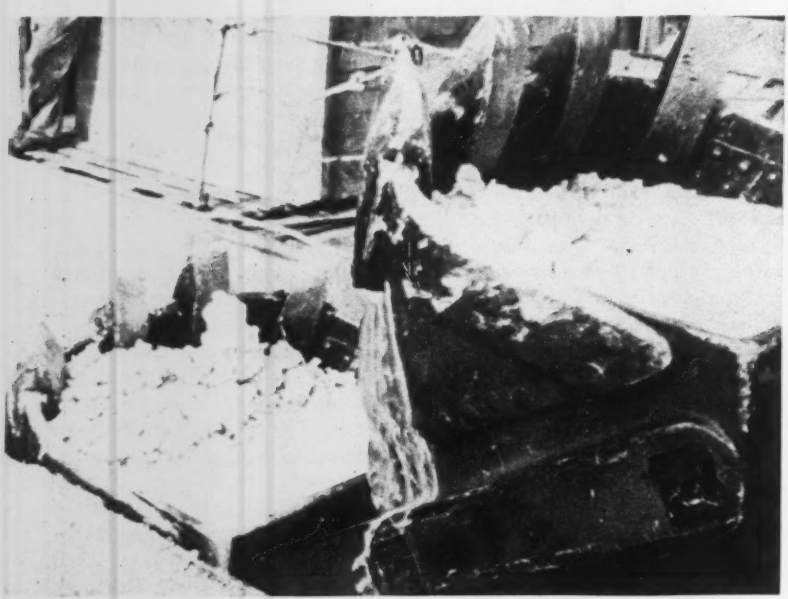


Fig. 3. Typical of the compact, calcareous rock cut loose and brought up by the ladder dredge.

Fig. 4. Pieces of rock this size were brought up on a bucket of the ladder dredge. Such pieces would not go through the discharge chute, a derrick being used to swing them to the disposal barge.

SUCTION-HOPPER DREDGE—OPERATING DATA

During 30 days operation a total of 720 hrs. was accounted for as follows:

	Hours	Minutes
Dredging	406	40
Turning	39	05
Trip to dump	78	48
Dumping	39	50
Returning to cut	47	00
Subtotal (effective working time)	611	23
Percentage of total time	84.9	
Taking on fuel and supplies	26	57
To and from wharf or anchorage	17	10
Minor operating repairs	5	10
Lay time, off-shift	54	13
Miscellaneous	5	7
Subtotal (non-effective working time)	108	37
Percentage of total time	15.1	

Ave. material pumped per min.	21.7 cu.yd.
Ave. pumping time per load	51.8 min.
Ave. quantity per load	1,124 cu.yd.
Ave. distance to dump (one way)	1.03 mi.
Ave. pump speed	155 rpm.
Total number of loads	378
Quantity dredged	529,423 cu.yd.

PHYSICAL COMPARISON OF LADDER AND SUCTION DREDGES USED

	Ladder	Suction
Length overall	292 ft.	268 ft.
Molded breadth	48 ft.	46 ft.
Draft aft, light	15 ft.	15 ft.
Draft aft, loaded	.....	20 ft.
Length of ladder frame	140 ft.	.....
Number of buckets on ladder frame	43	.....
Number of buckets per min. (normal)	11 to 12	.....
Capacity of largest buckets	3 cu.yd.	(approx.**)
Capacity of hoppers	*1,060 cu.yd.	1,150 cu.yd.
Fuel	Coal	Diesel electric

* Not used. ** Suction pipe 26-in. dia.
At an angle of 40 deg. the maximum dredging depth of the ladder frame is 54 ft.

case proved well-suited to this use. Naval authorities were somewhat reluctant to approve the use of a sea-going ladder dredge because of heavy equipment necessary for repairs in case of a breakdown. The danger of delay from this source was reduced to a minimum by providing adequate spare parts, including upper and lower tumblers, and assigning floating cranes capable of handling the heaviest repairs to the work. To date no major breakdowns have occurred.

Results have proved that the combined use of the suction hopper dredge and the ladder dredge was the best solution to the problem. The hopper dredge removed the soft material quickly and economically. The ladder dredge did its part, cutting and loading the tough calcareous rock, thereby eliminating the need of dobie blasting and saving considerable time in excavation. It is realized that the ladder dredge has not met with favor among dredging operators in the United States but this is an excellent dredging tool that warrants more widespread use than heretofore given it. This project has demonstrated its usefulness.

Wood Sewer Sound After Carrying Acids 17 Years

Many companies operating their own installations for the transmission of acidulous liquids or their discharge as wastes have found pressure creosoted wood an excellent material for such lines. The W. J. Bush Citrus Products Co., National City, Calif., recently removed a creosoted box cover that had carried acid wastes for 17 years but was still in good condition, according to the Wood Preserving News.

For many years the company has operated a plant for the extraction of juices from citrus fruits and oils from the peels of the fruit. The waste water from these operations contains ground-up peels, fruit remnants, and fruit acids. It was this water that the creosoted box had carried.

The sewer was built in April 1925 of 2x12-in. lumber in lengths of 12 to 20 ft. The timber was pressure treated with an average retention of about 8 lb. of creosote per cu.ft. of wood. The box, which replaced a precast concrete pipe, was covered with 3 ft. of earth. It was used constantly until 1942, when it had to be abandoned because of extensive land changes that were made at the point of discharge. When dug up and examined, the box was found in good condition and apparently would have continued to give good service for many additional years.

Prior to 1925, the company disposed of the waste by discharging it into the bay through concrete pipes of 10 or 12-in. dia. The usual service life of this pipe for the same purpose was 3 or 4 years.

Putting Postwar Plans into Reality

***Contents in Brief** — New York State is one of the leaders developing plans and specifications for public works projects to be undertaken in the postwar period. Progress already made and the manner in which the recently organized state postwar planning commission functions, are outlined in a recent report, from which the following extracts have been made.*

POSTWAR PUBLIC WORKS planning in New York State has advanced to the point where it is expected that before the war ends plans will be ready for the construction of $465,000,000 of state projects. This is revealed in a recent report of the state's Postwar Public Works Planning Commission, which points out that already design funds are available to prepare plans for more than half of this amount.

The commission, which was established by the state legislature in May, 1942, has undertaken to direct the preparation of plans and specifications for state work as well as prepare and maintain current progress information on the design of public works projects by municipalities. To broaden the scope of its activities it is now prepared to recommend to the legislature that sufficient funds be provided so that the state could contribute 50 percent of the cost of plans for approved municipal projects.

Activities of the commission are confined exclusively to a public works program, and the commission is not involved in social or economic planning generally. Furthermore, states the report, there is no connection whatsoever between this commission and any other agency—federal, state or local.

Principal objectives of the commission are listed as:

(1) Alleviation of a great deal of the unemployment caused by the transition of industries from wartime production to peacetime production, and by the demobilization of the armed forces.

(2) Stimulation of private industry.

(3) Orderly planning of the construction work that has been deferred because of the war.

With the use of funds available by other statutes and the $400,000 appropriated to the commission, there are at present design funds available to prepare plans for public works construction, the cost of which is estimated as follows:

Institutional buildings	$15,000,000
Grade crossing eliminations	60,000,000
Housing	80,000,000
Highways	90,000,000
Total	$245,000,000

The commission will recommend to the next legislature the appropriation of additional funds in order to continue the preparation of plans for postwar public works projects. It is hoped that before the war ends, plans will be ready for construction which can be started immediately of approximately $150,000,000 of state projects, and $105,000,000 of highways, throughways and parkways, or a total shelf of about $465,000,000.

Aid to municipalities

The commission has decided that one of its most important functions is the establishment of a reservoir of postwar projects within the municipalities. It has tentatively set as its goal a program of construction totaling $290,000,000; of this amount some $75,000,000 of projects are within New York City, while the balance of the program will be made up of projects from upstate communities. New York City, it is said, already has submitted projects totaling over $70,000,000.

Every community in the state—some 1,600 of them—has been canvassed by letter stating that the commission will recommend to the next legislature that sufficient funds be provided so that the state could pay 50 percent of the cost of plans for municipal postwar projects. Communities desiring to take advantage of this aid were asked to submit their projects as soon as possible. To expedite such action, three field representatives of the commission are traveling through the state and conferring with municipal officials.

The types of municipal projects deemed most desirable are those of a permanent nature, such as: Buildings, roads, storm sewers, sewage disposal systems and parks.

The commission is stressing the desirability of submitting projects the estimated cost of which is somewhere between $20,000 and $200,000. These are the reasons why small projects are being emphasized: (1) to assure the spreading of funds throughout the state; (2) such projects can be started more quickly and (3) more labor and materials can thus be utilized.

Cost must be shared

Municipalities are being urged to submit all contemplated public works projects—but only if they are willing to pay their half of the cost of preparing plans and specifications.

The commission has determined that no more than 1 percent of the estimated cost of a project shall be allowed for preliminary plans. These preliminary plans shall then be submitted to the commission for its approval. A revised estimate based on these plans and 1940 average costs shall then be agreed upon and the total amount, not to exceed 4 percent for the plans and specifications will be paid.

Legislation now is being drafted to permit localities to raise the necessary funds so that they can pay their share of the cost of the plans.

The advantages of local participation in this program are listed as follows:

(1) Plans for needed projects will be obtained at half price.

(2) Localities with plans available will be in a position to take advantage of any grants that may be available after the war. Although no one at this time can say what grants will be available, or to what extent they will be available, the commission points out that it is safe to say that grants of some kind will be forthcoming.

(3) Localities with completed plans will be in a good position to complete in two or three years the public works program that ordinarily would take five to ten years.

(4) Employment within the locality will be created, thus reducing the local relief burden.

To make provision for the financing of plans for self-liquidating projects by public benefits corporations, known as "Authorities," the commission has agreed to make some provision. The form in which this financing will be done is still under consideration.

Why postwar planning?

An appendix to the report contains a statement by Robert Moses, a member of the Commission representing the State Council of Parks, setting forth strong reasons for undertaking postwar planning at this time. In brief, Mr. Moses says:

Failure to prepare for peace is quite as serious as failure to prepare for war. But there are difficulties in the way of preparing a genuine reservoir of public works in wartime. Men's minds are fastened on the winning of the war, and only very incidentally on the peace which will follow.

A great many people, under the pressure of war hysteria, are almost afraid to be identified with work not closely or directly associated with the actual war effort, continues Mr. Moses. We already see innumerable people rushing into war activities for which they are not fitted, and actually confusing and interfering with war preparations, either because they can't keep their minds on the day's work, or because they are looking for a little spurious excitement. This is not to say that anyone should shirk any task which the government calls upon him to do. One of these tasks, however, is to fight against postwar unemployment, and those eligible for it should regard their selection as both an honor and an opportunity.

In this long-range strategy we should not overlook the possibility that the non-defense and non-war field of construction may to some extent be resumed before long—not on a great scale, but sufficiently to use up some of the plans we think we are storing away. This possibility is based on the as yet little recognized fact that the abrupt stoppage of civil work by green administrators unused to the exercise of authority, may produce unemployment troubles of a most serious kind in the middle of the war production drive, long before peace is in sight. A very delicate balance must be preserved between civil and war work if civilian morale is to be maintained. At the moment it is unpopular to refer to such axioms, but in the end economic truths do not yield to hysteria, states Mr. Moses.

Members of the commission

The legislation setting up the New York State Commission on Postwar Public Works Planning specifically mentions the agencies to be represented on it. These agencies and the names of the individuals who represent them are:

Director of the State Budget, J. Buckley Bryan (who is also chairman of the commission); chairman, Assembly Ways and Means Committee, Abbott Low Moffat (serving as vice chairman of the commission); State Superintendent of Public Works, Arthur W. Brandt; chairman, State Council of Parks, Robert Moses; State Commissioner of Housing, Edward Weinfield; director, State Bureau of Planning, Maurice F. Neufeld; chairman, Senate Finance Committee, Arthur H. Wicks; and the Joint Legislative Committee on Industrial and Labor Conditions, Irving M. Ives, Jacob J. Schwartzwald, and William B. Groat, Jr.

The staff appointed by the commission members includes: Holden A. Evans, Jr., executive secretary; Robert F. Wait, Ralph J. Hicks and Henry A. Strecker, Jr., field consultants; John T. Carroll, planning architect, and Stanley M. Bloom, research economist.

Action Needed Now On Postwar Plans for Public Works Construction

If we expect to launch an effective program of public works immediately upon cessation of hostilities, we need detail plans drawn in advance, we need to acquire the sites for our operations in advance, we need to know exactly what we are going to do and how we are going to do it. This was the message given by Kenneth Markwell, regional director of the Federal Works Agency, who recently addressed members of his staff on postwar planning philosophy.

We must be ready to put contractors to work the very day the war ends, stated Mr. Markwell. If we wait until the last shot is fired before we begin to translate plans into action, we may find the nation bogged down in another depression before work is started.

Many legislators and the general public appear to think that an appropriation of federal funds is all that is needed to initiate a public works program. They overlook the fact that unless architectural and engineering plans have been prepared in advance, months may elapse between the appropriation and the letting of contracts, and more months will pass before workmen can be hired and materials assembled to place projects into active construction.

It will take from six months to a year for war plants to re-tool and shift from the production of armament and supplies needed for our armed forces to the production of goods for civilian use. During the period of readjustment immediately following the war, we are likely to experience an economic depression no less serious than the one we weathered between 1932 and 1938, unless state and local communities begin now to plan public works programs that will provide jobs for workers released from war production plants and for servicemen coming home.

The states and communities that have a large number of projects for which detail plans have been drawn, sites acquired, and working plans ready to go into action the day peace is declared, are the ones least likely to suffer from the effects of a depression during the changeover from war to peace.

James J. Hill, the great railroad builder, once remarked that the only way to succeed in the field of construction and development is to first plan the work, then work the plan. This is good advice, continued Mr. Markwell, which I think might well be applied to postwar planning of public works.

Underground Channels Utilized For Airport Drainage

***Contents in Brief**—Drainage from a 265-acre airport in the Midwest is by disposal of the runoff into cavernous limestone underlying the site. A churn drill was used to cut through 10 to 20 ft. of rock to the caverns below and concrete pipe manholes were constructed to serve as intakes. Most of the runoff is handled by finished grades sloping toward the manholes, but some French drains paralleling the runways and discharging into the manholes also were required.*

AT LOW COST and with little building material, drainage for a small CAA airport in the Midwest was provided **in a hurry** by taking advantage of "sinkholes" that were prevalent in the area. Instead of an extensive collection network that would permit disposal of the runoff through long outfalls leading to the nearest streams, the drainage system was built of 3,100 ft. of french drains and 12 manhole inlets discharging into subterranean channels. The only other construction necessary was 2,020 ft. of 6-in. dia. vitrified clay tile to carry the discharge from the french drains to the manholes.

In addition to the low cost and speedy construction possible, the system constructed offered other advantages. First, if the completed system proves inadequate, additional drainage can easily be provided by construction of inlets at points where water collects. This new construction could be added without disturbing or or reconstructing the existing facilities. Second, maintenance charges will be low, and third, construction of the drainage works caused little interference to the grading work and did not delay the paving operations.

The 265-acre field, which is to provide four 150-ft. wide runways, 3,900 ft. long, is located in "sinkhole" country where natural drainage is primarily by sinkholes draining into the frequent caverns and channels in the underlying honeycombed limestone; the nearest stream is about 2½ miles away. The limestone, or cathedral rock as it is commonly known, is 10 to 20 ft. deep and it is overlain by 15 to 20 ft. of dense red clay. Below the cathedral rock the limestone is honeycombed with numerous channels and caves, a condition that prevails for large areas in the vicinity of the field.

Location of the twelve manholes is shown by Fig. 1, as is the layout of the field and the location of the french drains and the 6-in. dia. vitrified tile joining the drains to the manholes. To provide some "ponding" the field is sloped toward the manholes on a one-percent grade for about 25 ft. in all directions from the inlets.

A standard manhole is shown in Fig. 2. It will be noted the upper part is a 5-ft. high section of reinforced concrete pipe, 25 in. in diameter at the top and 48 in. at the bottom. Each section cost $75 complete with cast iron grating. The inlet continues down to cathedral rock as a 48-in. dia. reinforced-concrete pipe, which cost $12.50 per foot, including manufacture and placement of the sections. From the bottom of the manhole down through the cathedral rock a 12-in. dia. outlet is provided.

Construction of the in-lets

In constructing an inlet the 12-ft. dia. hole leading to the subterranean channel was first drilled. The truck-mounted derrick drill shown in Fig. 3 was used. It was operated by a two-man crew and the contract cost was $10 per lin. ft. of hole.

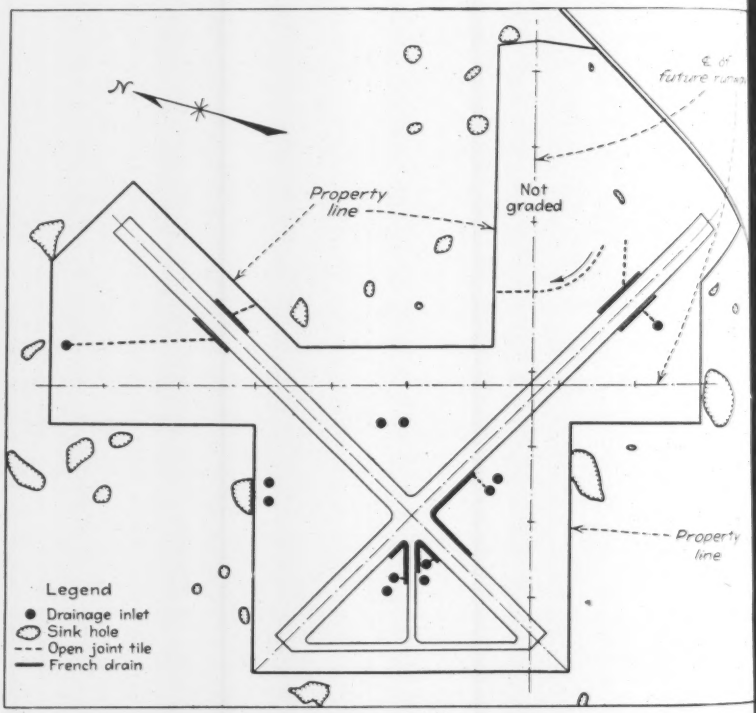


Fig. 1. For drainage of the entire 265-acre airport only twelve manhole inlets were required. The field, which is graded to permit some ponding at inlets, slopes from the southeast corner to the northwest corner with a difference in elevation of about 20 ft. between those points.

Sometimes it was necessary to clean out and make bigger the channel at the bottom of the drill hole. When the channel had to be enlarged, a charge of 10 to 12 sticks of 60 per cent dynamite was first packed in the bottom of the hole and detonated. After the drill was "churned" up and down to pulverize the rock that had been loosened, a charge of 1,000 to 2,000 gal. of water was added rapidly from a tank truck to test the adequacy of the new channel.

If the channel was found to be sufficiently large, a hole of 6-ft. minimum diameter was excavated to bed rock by hand. When the excavation was complete, the sections of the 4-ft. dia. reinforced-concrete pipe, which had tongue and groove joints, were lowered into place by a truck crane and the joints sealed with cement mortar. The top 5 ft. was delivered as one section and when it was in place the backfill was added and compacted by hand.

Only in a few places were french drains required and where needed they were built along the edge of the runway pavement. In constructing the drains a ditch about 2 ft. wide and 3 ft. deep was dug by hand. In this channel a 6-in. layer of ¾-in. maximum size stone was placed, then a 6-in. dia. concrete pipe with open joints and finally a 2-ft. minimum cover consisting of 14 in. of crushed rock of 3½ to 1½-in. size and 10 in. of pervious soil. Most of this stone was of 3½-in. size but the top 1 in. was of 1-in. material. Delivered by truck, the stone was dumped directly into the trenches, spread by hand, and compacted in place. Cost of the french drain was 15 c. per lin. ft. for excavation and $1.12 per lin. ft. for the remaining construction, including the cost of the materials.

Drains connected to manholes

To carry the discharge from the french drains to the manholes, 6-in. dia. vitrified clay tile with tight joints was used. In all 2,020 ft. of this tile, which was placed with a 2½-ft. cover, was required. Cost of this construction, including materials, was $1.00 per lin. ft.

During the grading operations heavy rains occurred, which opened up several sink holes necessitating particular treatment. To repair the damage, which occurred in only a few places, a hole of 5 to 10 ft. dia. and with side slopes 1½ to 1 was excavated down to the cathedral rock. The lower 3 ft. of the hole was filled with hand placed 1-man stone or pieces weighing about 100 lb. Next a 3-ft. layer of 6-in. stone and a 3-ft. thickness of 1-in. stone was added and the remainder of the hole filled with compacted top-soil.

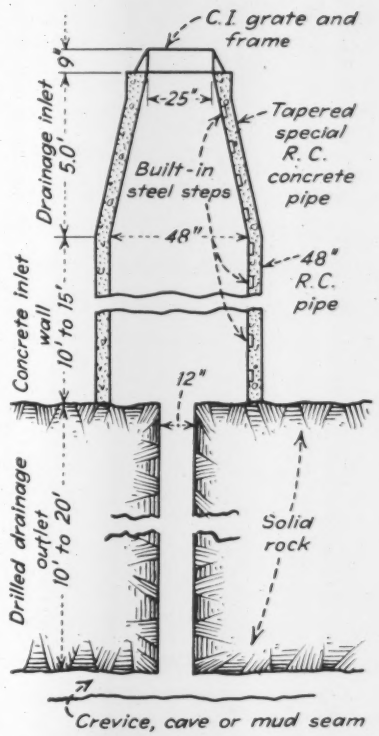


Fig. 2. Manhole inlets of the type above were used. The top 5 ft. section complete with cover cost $75 and the lower portion with straight sides $12.50 per foot. For the entire field of 265 acres only twelve inlets were required.

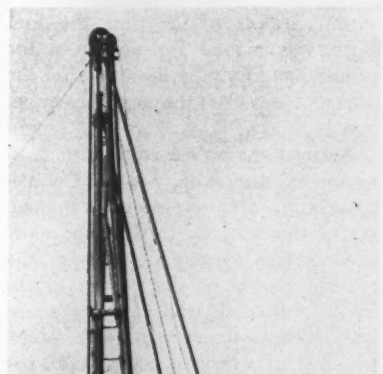


Fig. 3. The 12-in. holes through the rock below the manholes were made by this derrick drill at a cost of $10 per foot of rock. The drill was operated by a crew of two men.

The airfield is a CAA project, construction being supervised by the Louisville District, U. S. Engineers, where Col. Henry F. Hannis recently replaced Col. Henry Hutchings, Jr., as district engineer. Donn L. Wright is resident engineer. The general contractor was Brooks Construction Co., B. E. Lathrop, superintendent.

Miners Build London's Deep Underground Shelters

Work on deep tunnel air-raid shelters under London's existing subways has made rapid progress in recent months. Each of the eight shelters—four north and four south of the Thames River—will consist of two tunnels about 1,400 ft. long with a 16-ft., 6-in. diameter. The two tunnels run parallel, and two floors are added in each, one near the bottom and one at the mid point. The floors will permit installation of 8,000 bunks in tiers in each shelter.

Ventilation, sanitation, medical aid posts, warden's posts, and canteens are provided in each shelter, and there are duplicate electric power and lighting systems. Small service lifts with 900-lb. capacity are available. The main working shafts are of 16 ft. by 16 ft. 6 in. and will later be used to accommodate spiral staircases.

The shafts were sunk ring by ring by underpinning. The casting rings are 20 in. deep and consist of eight segments and one key piece. They are bolted together and caulked when necessary. Some 24,000 tons of cast iron will be necessary for the tunnels.

Horizontal tunnelling is being done by a novel system. Two superimposed tunnels of 12-ft. dia. are being excavated; the upper one a few feet ahead of the lower one. This can be done by hand, at a rate of two rings per 12 hours, but at least one of the five contractors employed is using a shield built from available material, with result that the progress per shift was doubled. Otherwise work would have been held up by the shortage of skilled miners; normally one miner works with two other skilled men and four laborers.

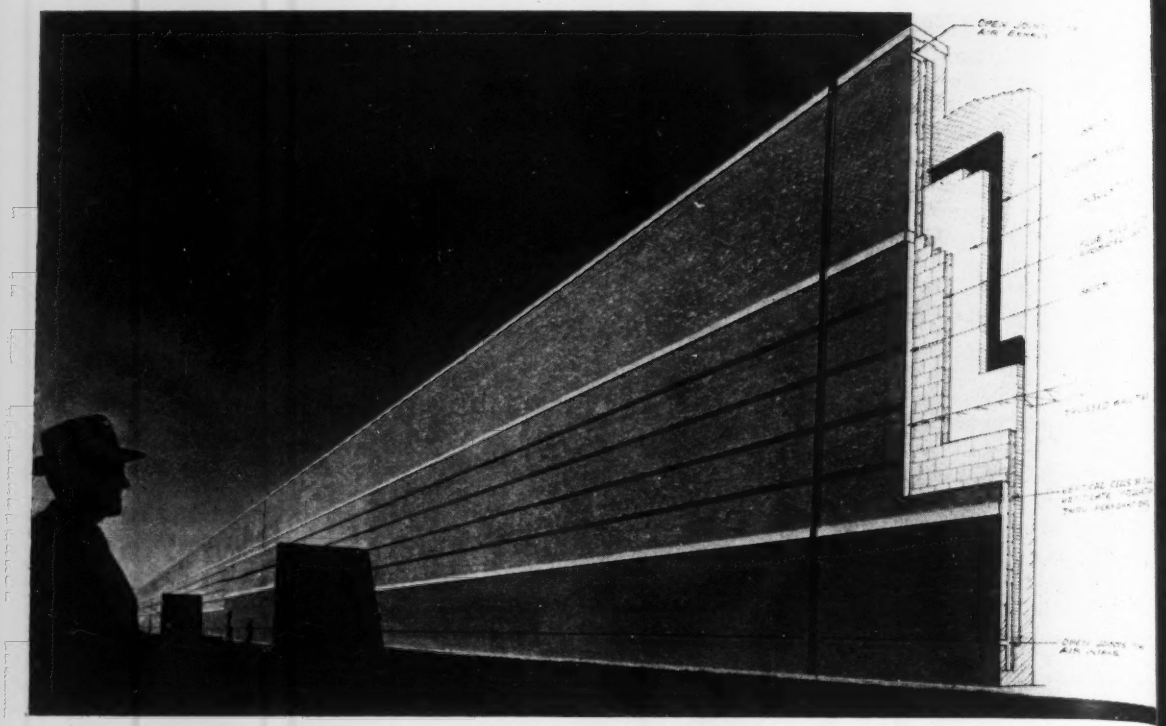


Fig. 1. Air taken in at bottom and exhausted at top keeps insulated brick wall free from condensation.

Ventilated Design for Windowless Walls

***Contents in Brief**—New Douglas aircraft plant in Oklahoma meets requirements of critical materials conservation by using brick instead of steel sheet walls, as was done on previous plants of similar character. Walls, 50 ft. high, contain tile flues for ventilation and a 4-in. blanket of rock wool. White cement floors, light-green painted walls and an exposed ceiling blanket of glass wool aid light reflection from fluorescent units mounted in enameled fiber board reflectors.*

SPEED OF ERECTION and conservation of critical materials are construction highlights of Douglas Aircraft Co.'s new plant at Oklahoma City. Erection of the huge structure was paced by the installation of machines for aircraft manufacture, so that by the time the building was complete Douglas C-47 "Skytrains" were coming off the production line. And all this within a year of the time the first earth was moved for access to the project, and only 8½ months after the start of erection of the assembly building.

Restrictions on use of steel made it necessary for The Austin Co., of Cleveland, architect-engineer-managers of the project, to develop many conservation ideas. Outstanding, and readily visible, is the design of the 50-ft. high brick wall of the windowless, "controlled-conditions" plant, which is of a special ventilated type; its designer, Albert S. Low, vice president and chief engineer of Austin, calls it a "breathing" brick wall.

Ventilation is used to prevent condensation of moisture and keep the wall dry, an unusually important factor in the huge, completely closed, buildings common to aircraft manufacture. The windowless feature is not for blackout, but is used as an aid to the manufacturing process by maintaining a constant temperature and humidity.

The wall, from outside in, is made up of a course of common brick; a course of tile with perforated ba laid with openings vertical; a 4-in blanket of rock wool; a vapor se paper; and two courses of brick. Th wall is laid with two stretcher course about waist high that have the ver tical joints open for air intakes. These admit air to a flue formed by the tile, the perforated backs of which are in contact with the insulating blanket, which is kept dry by suction up the flue. At about roof level, a rowlock course of brick, with vertical joints open, forms an air exhaust. Built thus, the insulating value of the wall is said to be equivalent to 80 in. of brick.

Trussed wall ties at each fourth course of brick tie the outside brick to the inside, and furnish supports for the vertical tile and the insulating bats. The wall was laid in a continuous vertical lift from a scaffold, supported from the building steel and raised by small winches.

The wall design is recognized as one of necessity rather than economy

s it is more expensive construction han the steel and glass wool wall used n similar plants in the Southwest. It was expected that the brick might delay the work, as no one was familiar with the wall contemplated. Job records, however, show that the brick construction kept pace with steel erection and other work. Brick, of which 7,000,000 were required in the two miles of wall, was trucked in as needed from nearby Oklahoma plants.

The roof construction consists of an insulated metal deck, with built-up gravel-surfaced roofing laid directly on the insulating mat. Another insulating mat is supported below the deck on rib mesh just above the bottom of the purlins, increasing the insulation value and providing a surface for light reflection.

Efficient artificial lighting

While the new plant provides the same ideal working conditions and manufacturing facilities as the finest "controlled-conditions" plant designed before the need for metal conservation became apparent, it has only half the steel required in earlier plants. A saving of 170 tons of steel, for example, was made by the use of masonite instead of porcelain enamel in reflectors for more than 20 miles of continuous fluorescent lighting fixtures, which have been equipped with a new double-duty lighting mechanism (4-lamp, high power-factor, 254-volt ballasts instead of 2-lamp ballasts), that saves an additional thirty tons of vital war materials, mostly copper and aluminum.

The non-metallic reflectors have a synthetic enamel surface equal to porcelain in light-reflection qualities. They carry a double row of 100-watt fluorescent lamps, and are continuous in the huge assembly bay where 16 unbroken strips provide uniform illumination of 55 ft. candles. Mounted 40 ft. above the floor, they are suspended from bar joists that rest on the monorail supports. Normal gray cement was used for the floor of the manufacturing area, but white cement was used as a topping for the floor in the assembly section of the plant to provide, by reflection, better light on the under side of wings and fuselage. Additional reflected light is provided by the walls, which are painted a light green above a darker green dado. A special paint, suited for use on brick, having a high alkaline content, was required for the walls. For-

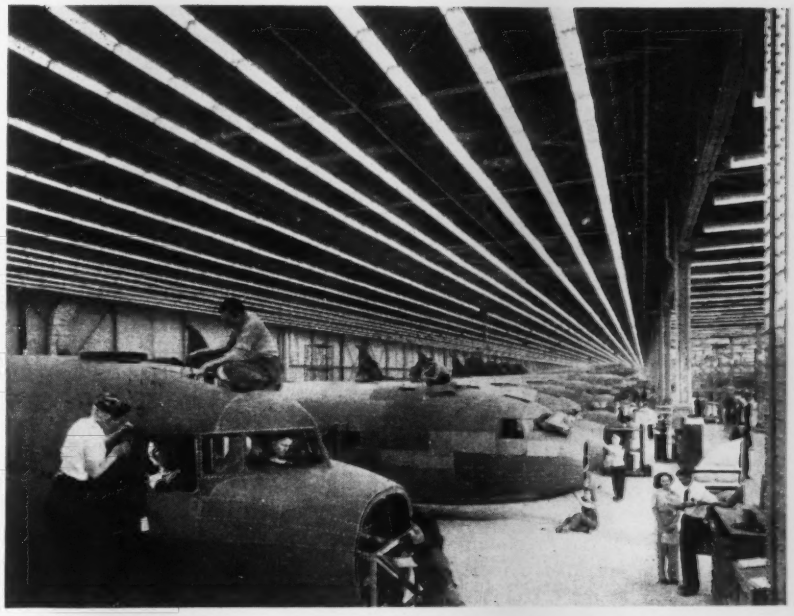


Fig. 2. Continuous rows of fluorescent lights mounted in enameled fiber board reflectors save critical metals, yet provide 55 ft. candles of illumination on the white cement floor.

tified with a wax material, the paint is a good light-reflector, and has a high resistance to dust accumulation.

The manufacturing section of the plant is served by 20-ton capacity overhead bridge cranes that move longitudinally along any of the several aisles. Turntables in the overhead rail also make it possible for a crane, with load, to pass transversely into any bay of the area. The lighting system is serviced from traveling bridges operating on the crane rails.

Austin Co. installed the manufacturing machinery for Douglas to produce at this plant 85 percent of everything going into the two-motored transports. (The C-47 is a work-horse version of the DC-3 commonly used by the commercial air lines). The equipment was placed as rapidly as roof, wall and floor were completed, the Douglas people taking over areas as they were available, so that the first ships were flown before the building was completed.

In addition to the assembly structure, the plant includes an administration building, a huge hangar, and a paint shop that accommodates two of the transport planes.

A. D. Engle was project manager in charge of design and construction for the Austin Co., H. E. Eiber was assistant project manager, and C. R. Brewer was general superintendent. George P. Reynolds was in charge of architectural design. Fulcher and Poyner were subcontractors on the brick construction.

The plant was built for operation by the Douglas Aircraft Co., Inc., with War Department funds, administered by the Corps of Engineers of the Army. Col. Frank J. Wilson is head of the Tulsa district office, and Major E. A. Cornell, area engineer.

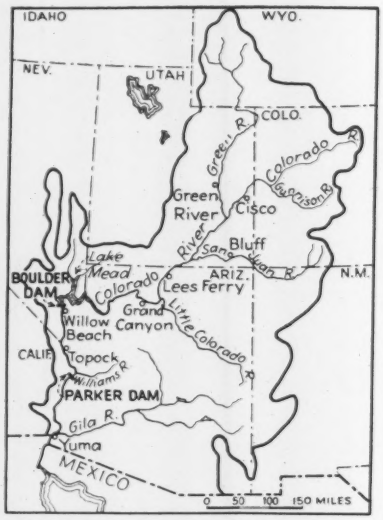
Marsh Lands Reclaimed

Reclamation of marsh lands by drainage pumping, which has been carried on in England for many years, is being extended as a war project for increased agricultural development. A recently completed section of 5,000 acres (half of the area of this particular project), in Cambridgeshire, and below the high tide level of the River Ouse, is protected by dikes or levees and drained by canals and ditches leading to a pumping station having two oil-engine pumps, each of 18,000-gpm. capacity. Nearly 20 miles of 9-ft. concrete roads have been built and much of the area is already under cultivation for wheat and vegetables. In clearing the land, many ancient bog-oak stumps of 3 to 4-ft. diameter had to be removed, either by a special stump-plow and tractor or by blasting. The cost of clearing and reclaiming is $40 to $80 per acre.

High Silt Content of Colorado River

RECORDS OF ANNUAL RUNOFF and load of suspended matter in the Colorado River and its tributaries, summarized recently by the U. S. Geological Survey, show the enormous amount of solids carried in suspension by this river (giving it the appearance from which its name was derived), but do not appear to indicate definite relation of runoff to solid content. In records covering more or less completely a term of 16 years at seven stations, the maximum flow and maximum silt load coincided in the same year at three stations; and the minimum flow and minimum silt load coincided similarly at three stations. At only one station (Grand Canyon) did both the maximum and minimum coincide. In the annual records, the relations of runoff and silt content vary widely.

These annual records are given in the accompanying table. Those of the first three stations are independent and have no relation to each other, since the stations on the Green River and the San Juan River are above the confluences with the Colorado River, as shown in the accompanying map. On the other hand, the Grand Canyon station is below these two important confluences, and with the completion of Boulder Dam the rate of flow is checked by absorption in the vast reservoir formed by the dam. While the Little Colorado River also enters above the Grand Canyon, there are no comparable records for this stream. For the stations at Lee's Ferry (above the dam) and Willow Beach (below the dam), the records cover only a few years.



Points at which the silt content of the Colorado River are measured.

In relation to the character of the water discharged from the dam, a significant indication of the table is in the change of the records at Topock (below the dam). Until 1934, the annual silt load passing there had ranged from 61 to 437 million tons. With the beginning of discharge through the diversion tunnels in 1936, the figures were 20 and 9.7 million tons for 1936 and 1938 respectively. No later observations were made in view of these low figures.

The annual load at Grand Canyon ranged from 50,300,000 tons in 1933-34 to a maximum of 430,000,000 tons in 1928-29, the mean for 16 years (1925-1941) being 200,000,000 tons. In the report above mentioned, it is stated that: "The mean annual runoff for the 16-year period was somewhat less than the estimated annual long-time runoff, and it seems probable that the mean annual load of suspended matter over a long period of years may be higher than the value computed for the 16 years of record."

When the discharge from Lake Mead began in 1935, the water was said to be "crystal clear" for some months, but later became muddy, although the water of the lake was clear. This change was considered due either to the fact that the heavier silt-laden water moved along the bottom, or that silt deposited in the upper reaches of the lake was being eroded by bottom flow. Samples

RUNOFF AND SILT CONTENT OF THE COLORADO RIVER

R = Runoff; million of acre-feet. S = Silt; million tons
$_a$ = Maximum record $_b$ = Minimum record

Year	Colorado River at Cisco		Green River at Green River		S. Juan River at Bluff		Colorado River					
							Lee's Ferry		Grand Canyon		Topock	
	R	S	R	S	R	S	R	S	R	S	R	S
1926	.....	.....	.....	.....	.....	.....	14.0	.....	14.4	225.0	14.3	140.0
1927	.....	.....	.....	.....	.....	.....	16.5	.....	17.3	398.0	17.0	345.0
1928	.....	.....	.....	.....	1.7	.....	15.3	.....	15.6	172.0	15.4	209.0
1929	8.5$_a$	.....	6.4$_a$	.....	3.1	.....	19.2$_a$	352.0	19.4$_a$	480.0$_a$	18.9$_a$	437.0$_a$
1930	6.1	18.6	4.5	34.5	1.7	58.5	13.1	112.0	13.4	235.4	13.2	243.0
1931	2.8	9.9	2.4	7.4	0.8	15.3$_b$	6.4$_b$	57.2$_b$	6.7	68.8	6.7	64.7
1932	6.7	26.4	4.8	36.1	2.3	75.3	15.3	214.0$_a$	16.0	261.0	16.1	272.0
1933	4.6	8.2	3.5	15.3	1.2	23.6	9.7	112.0	10.0	178.1	10.2	121.4
1934	2.2$_f$	2.7$_b$	1.3$_f$	1.8$_b$	0.6$_b$	21.1	Willow Beach		4.6$_b$	50.3$_b$	4.8	61.0
1935	4.7	17.8	2.8	14.3	2.1	42.7	5.5$_b$	13.9$_b$	10.2	122.3	5.2	27.8
1936	5.7	17.2	4.1	33.8	1.6	32.6	6.2$_a$	6.8	12.3	157.6	6.0	20.1
1937	4.6	23.5	4.1	43.4$_a$	2.3	52.2	5.8	0.3$_b$	12.4	191.3	5.5	10.7
1938	7.4	35.7$_a$	*4.7	38.2	2.4	52.1	6.1	0.4	15.6	232.4	5.9	9.7$_b$
1939	4.2	14.4	3.4	22.8	1.2	21.4	8.4	.....	9.6	86.3	8.1	.....
1940	3.4	9.9	2.3	8.9	1.0	26.3	.....	.....	7.4	75.4	.....	.....
1941	6.6	32.2	4.2	32.0	4.2$_a$	112.7$_a$	.....	.....	16.9	270.0	.....	.....

ken in 1937 showed clear water in upper levels of the lake, while se at lower levels were not only of her temperature and higher spe- ic gravity, but " had the color and sistency of thick chocolate." As future conditions of silt removal in t portion of the river below ulder Dam, an article in the Octo- r. 1937, issue of *Reclamation Era* ted as follows:

"A new river grade is being estab- ed below Boulder Dam by the moval of a large volume of fine ma- ial from the old bed. As the cut- g waters bring each additional mile its new grade, a mile of river once mous for its silt content is replaced a mile of clear water. Each mile added assures Parker Reservoir bout 100 miles below Boulder Dam) of longer life, and will aid materially in the development of such recreational attractions as fishing, bathing and boating."

In average content of dissolved solids in the Colorado River, the records of the U. S. Geological Survey show a range of 0.67 to 1.11 tons per acre-foot for the nine years 1926-1934, and the average was assumed as 0.81 ton. With a capacity of 30,000,000 acre-ft. for Lake Mead, it was estimated that in 50 years the silt deposit would amount to 3,000,000 acre-ft., or 10 percent of the capacity. In the planning of the dam and works, allowance was made for a deposit of 10,000,000 acre-ft. in 150 years, and it was estimated that it would take practically 500 years to fill the reservoir with silt.

Emergency Waterworks Repairs Under War Conditions

War emergency repair work for ter supply systems is discussed by W. Johnson in the official bulletin the Illinois State Board of Health, r the purpose of stressing the im- rtance of "preparedness" and sug- sting lines of action to be followed. Responsibility for maintaining the stem in service should be divided ong the departments, each section ad being best fitted to visualize the mage that may occur to his section the property. In case of bombing, e distribution system is almost sure be fractured at one or more loca- ons. Possible effects of aerial bomb- g should be studied from three oints of view: (1) transmission of essages from the point of damage the central supply yard or point of ecting the emergency work; (2) osure of valves on broken mains so to regulate and control the flow water; (3) methods for making e necessary repairs.

In "valving off" a section of main, e simplest case would require the osing of only two valves. Where a reet intersection is blocked by debris om falling buildings, so that it is ecessary to go back to the next set valves, the number to be operated ight be doubled or tripled. The first ep should be to check the valve map ith the actual locations of the valves, ch valve box or manhole cover then eing painted a distinguishing color so as to be recognized easily by the emergency repair gang. Valve locations should be so described on the maps that they can readily be found at night or when covered with ice or snow. Repair trucks should carry dip needles or other electric devices for quickly locating valve boxes during the winter.

After the maps have been brought up-to-date, a special crew should be trained to operate all valves to make sure that they can be closed when occasion arises.

Water and fire

Dependability of water service in case of air raids is of prime importance, because of the use of both demolition and incendiary bombs. If the enemy can put the water system out of commission, so as to hamper the fire department, the city might be destroyed by conflagration.

In emergency work, it can be assumed that the closing of valves will be seriously delayed. Bombs that damage water mains will also wreck buildings, filling the streets with debris that will hinder the men in getting to the job. A special call may have to be sent to the yard for excavating equipment to clear away the debris before the valves can be located. Distribution studies may indicate that additional valves or short runs of pipe to tie together the principal mains may render the system more flexible.

Repair work is not likely to be an easy task. Air raids are made usually at night, and lights of any kind may be dangerous as targets for the enemy. It may be impossible to move trucks to the bomb crater, so that pipe and tools will have to be carried by hand over the debris. Pumps for dewatering the crater may have to be hauled in by hand. Gas masks will be needed if adjacent gas mains are broken.

Speeding temporary repairs

Temporary repairs may be speeded by using "jumpers" of smaller diameter for connections across or around the crater. A run of 30 to 50 ft. of pipe having half the cross-section of the main will reduce the pressure by only ½-lb. or less. Experience in England favors permanent repairs, unless the extra time would cause a fire hazard. At the start of the war, seven hours was the time for repairing a broken main. By study, preparation and practice, this time has been reduced to less than two hours.

The standard lead joint may be used, but the mechanical gland type of joint used by the gas industry is much quicker, requires fewer tools and has greater flexibility in case of settlement in the trench. A good supply of mechanical joints and solid sleeves should be on hand. A square break across a pipe can be repaired quickly by a split sleeve with mechanical joint, while several hours would be required with solid sleeve and bell-end joint made with poured lead. Broken mains may have jagged ends that require considerable cutting or trimming in order to be covered by the standard short sleeve. Extra long sleeves, about 24 in. long, are suggested by the National Committee on Civilian Defense.

Health protection

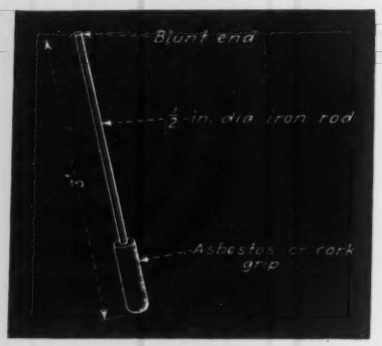
While fire protection is given first consideration in war time, the health problem must not be overlooked. Sterilization of all sections of mains installed should be a part of the repair work. This applies specially to broken mains in bomb craters which allow sewage, mud, debris, and all kinds of foreign matter to enter the water system. Liberal amounts of chlorine compounds should be kept on hand for quick sterilization of broken mains.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Heat Cure for Rusty Taps

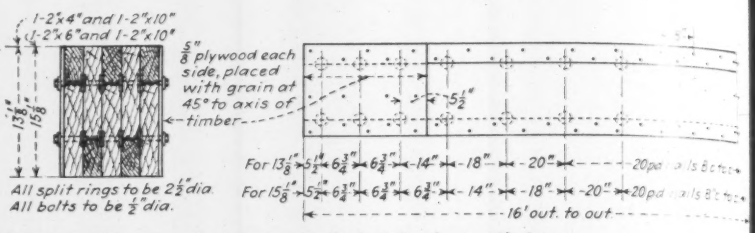
When dismantling machinery, rusty taps are a common nuisance, and it usually happens that the most stubborn ones are located in places hardest to get at with a wrench. Under present conditions, taps and bolts must be saved whenever possible, and for rusty ones, what a field parlance is termed a 'hot-rod' is proving very helpful. This tool is a ½-in. dia. iron rod, 3 ft. in length. When a tap refuses to un-thread, we heat the blunt end to a red color by torch, and hold the tip for a few minutes against the tap. Heat from the rod causes the metal tap to expand sufficiently to break the rust-film, and the tap generally turns off easily.—F. R. Cozzens, Equity Oil and Gas Co., Stockport, Ohio.



Built-up Beams Substituted for Heavy Timbers

When heavy timbers were demanded for navy camp construction faster than they could be supplied, built-up beams were substituted. These were made of readily available 2x4, 2x6 and 2x10-in. lumber assembled with ring connectors, bolts and spikes. A 2x4 and 2x10 are used to make a substitute 14-in. depth and a 2x6 and 2x10 are used for 16-in. depth. Three nominal 2-in. thick pieces are used to substitute for 4-in. thickness, 4 for 6 in., 5 for 8 in. and 6 for 10 in.

The made-up timbers do not always equal the depth or thickness of the original but they have the required strength for their intended use. Sizes of built-up beams that may be substituted are shown in the table.


1-2"x4" and 1-2"x10"
or 2-2"x6" and 1-2"x10"
⅝" plywood each side, placed with grain at 45° to axis of timber
5½"
For 13⅞" 5½" 6¾" 6¾" 14" 18" 20" 20p
For 15⅞" 5½" 6¾" 6¾" 6¾" 14" 18" 20" 20p
All split rings to be 2½" dia.
All bolts to be ½" dia.
16' out. to out

Beams built-up as above are substituted for heavy timbers.

Split ring connectors, 2½-in. dia., are used across each joint and the wider pieces are alternated top and bottom of the beam. As the splice occurs at some distance from the extreme fibers, the beam can be figured at the full value of a solid timber. Bolts, ½ in. dia., are used to pull the members into a composite beam, and all members are nailed with 4 rows of 20-d nails at 8 in. c. to c.

Eggers & Higgins of New York City designed the beams for use of Chas. H. Tompkins Co. on work at the Navy's Camp Bainbridge.

TABLE OF BEAM SIZES

Design	*Permissible*
4"x14"	4⅜"x13¾"
6"x14"	6½"x13¾"
8"x14"	8⅝"x13¾"
10"x14"	9⅞"x13¾"
4"x16"	4⅜"x15¾"
6"x16"	6½"x15¾"
8"x16"	8⅝"x15¾"
10"x16"	9⅞"x15¾"

Safety Methods in Obtaining Soundings above Niagara Falls

In connection with some contemplated work at Niagara Falls, a topographic survey was made last summer by the Buffalo District Office, U. S. Engineers, of the rock shelf on the Goat Island side of Horseshoe Falls. The accompanying photograph gives an idea of the safety measures.

Safety lines, on the same principle as those used by mountaineers, were run from shore to an anchor man, who can be seen on the rock islet in the left center of the picture, and from him to the rodman with wading boots, near the crest of the rock ledge.

Due to low water in this area last summer, areas never before accessible were reached and surveyed by the Buffalo Office of Army Engineers by this method.—Lieut. Col. Harland C. Woods, Assistant, Corps of Engineers, Buffalo, N. Y.

Protected by safety lines, rodman takes soundings on shelf above Niagara Falls.

Charts Speed Calculations for Concrete Columns

To avoid the extensive time loss in using the cumbersome formulas listed in the code of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, 1940 Edition, in designing columns for combined direct and eccentric loading the accompanying charts were prepared. The code fixes the extreme fiber stress in compression at 0.25 f'_c and 0.45 f'_c for direct stress and bending, respectively. It specifies that the maximum values for direct stress and bending shall be determined according to the formulas

$$f_c = f_a \frac{1 + \frac{ec}{R^2}}{1 + C\frac{ec}{R^2}}; f_a = \frac{0.225 f'_c + f_s p_g}{1 + (n-1) p_g}; \text{and } C = \frac{f_a}{0.45 f'_c}$$

These formulas are cumbersome and time-consuming, since several trials are usually necessary before a section is fixed for stresses within the allowable limit. Thus, the writer worked up charts on the basis of these equations for a 2,500-lb. and a 3,750-lb. concrete.

From the charts the allowable f_c is obtained as follows: Enter the chart at bottom with the percentage of reinforcement, and travel vertically to the intersection with the curve marked $0.8 f_a$ for a tied column or f_a for a spiral column; then horizontally to the proper $\frac{e}{t}$ value and last upward to the f_c scale at the top, which gives the desired value.

The charts also are convenient for preliminary design. Since stress f_c, percentage of reinforcement, and the $\frac{e}{t}$ values are tied together by a fixed relationship, it follows that for any two values, the corresponding third quantity is easily obtained. Thus, if the section and the stress are assumed, compute $\frac{e}{t}$, enter the chart with the assumed stress, move down vertically to the proper value of $\frac{e}{t}$, then horizontally to the intersection with the f_a or $0.8 f_a$ curve, as the case may be, and next down to the required percentage of reinforcement.

If the assumed quantities are the percentage of reinforcement and the stress, f_c, one starts at the bottom of the chart with the percentage of reinforcement, travels upward to the f_a or $0.8 f_a$ curve, then horizontally to the vertical line through the assumed stress. The point found is the value of $\frac{e}{t}$, and hence the depth of the section is determined.

As illustrated the charts are very flexible, useful and time saving. Although the values of f_a and C are given on the left hand side of the chart, they do not enter into the procedures explained.—JOSEPH ZALKIN, U. S. Engineer Office, Arlington, Va.

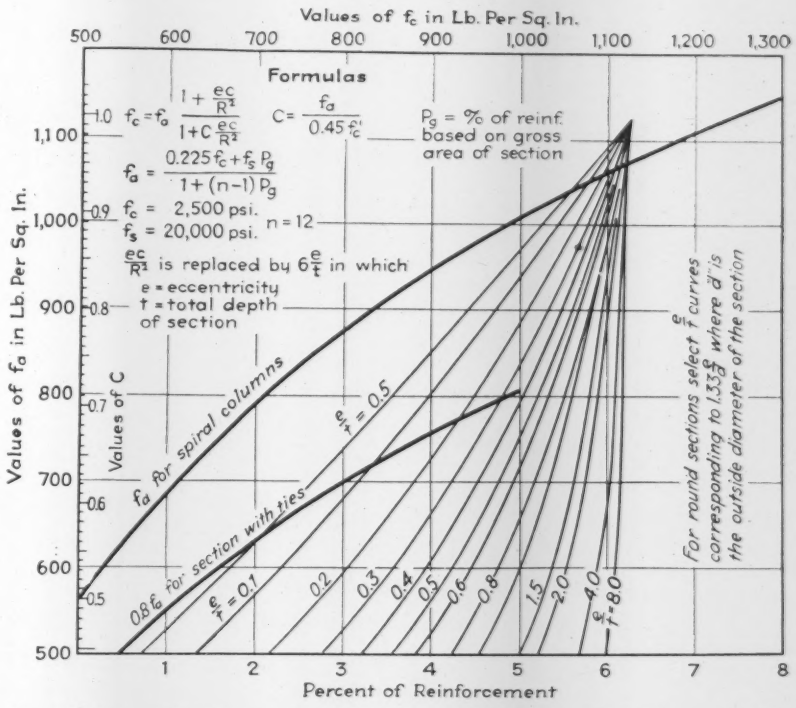

Values of f_c in Lb. Per Sq. In.
500 600 700 800 900 1,000 1,100 1,200 1,300
Formulas
$f_c = f_a \frac{1 + \frac{ec}{R^2}}{1 + C\frac{ec}{R^2}}$
$C = \frac{f_a}{0.45 f'_c}$
P_g = % of reinf. based on gross area of section
$f_a = \frac{0.225 f'_c + f_s P_g}{1 + (n-1) P_g}$
f'_c = 2,500 psi.
f_s = 20,000 psi.
n = 12
$\frac{ec}{R^2}$ is replaced by $6\frac{e}{t}$ in which
e = eccentricity
t = total depth of section
Values of C
1.0 0.9 0.8 0.7 0.6 0.5
Values of f_a in Lb. Per Sq. In.
1,100 1,000 900 800 700 600 500
f_a for spiral columns
$0.8 f_a$ for section with ties
$\frac{e}{t}$ = 0.1 0.2 0.3 0.4 0.5 0.6 0.8 1.5 2.0 4.0 ∞
For round sections select $\frac{e}{t}$ curves corresponding to $1.33\frac{e}{d}$ where d is the outside diameter of the section
1 2 3 4 5 6 7 8
Percent of Reinforcement

Chart 1. For a 2,500-lb. concrete this chart supplies quickly correct value for f_c.

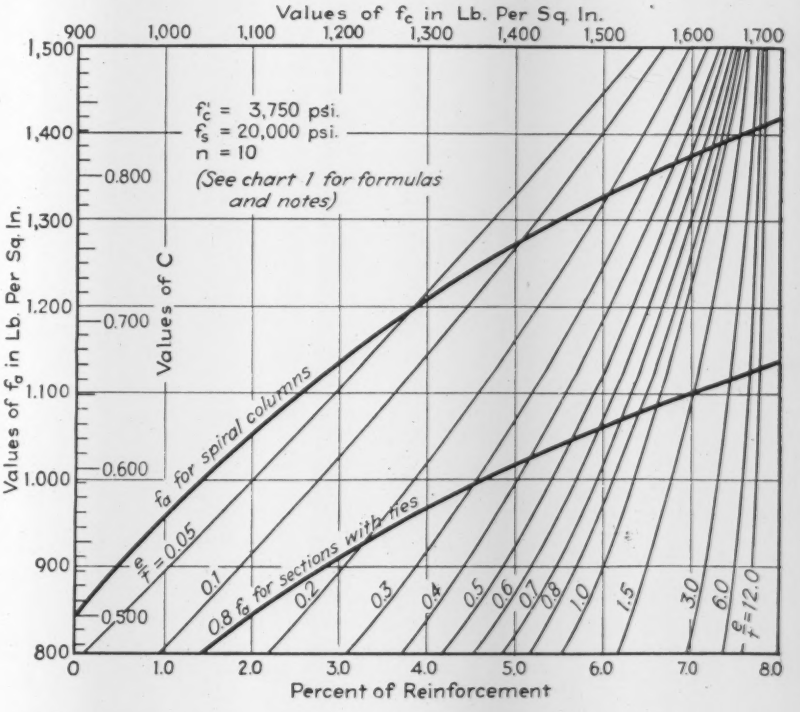

Values of f_c in Lb. Per Sq. In.
900 1,000 1,100 1,200 1,300 1,400 1,500 1,600 1,700
f'_c = 3,750 psi.
f_s = 20,000 psi.
n = 10
(See chart 1 for formulas and notes)
Values of C
0.800 0.700 0.600 0.500
Values of f_a in Lb. Per Sq. In.
1,500 1,400 1,300 1,200 1,100 1,000 900 800
f_a for spiral columns
$0.8 f_a$ for sections with ties
$\frac{e}{t}$ = 0.05 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 1.0 1.5 3.0 6.0 12.0
0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0
Percent of Reinforcement

Chart 2. For a 3,750-lb. concrete this chart is used to determine f_c.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Brick Construction

HANDBOOK OF BRICK MASONRY CONSTRUCTION—John A. Mulligan. 526 pp. McGraw-Hill Book Co., New York and London. $5.

Few books on brick construction have appeared in recent years, hence information on that subject is difficult to find. This new handbook undertakes to bring into one volume all the information concerning bricks and brick construction needed by engineers who must specify or inspect brick construction and by contractors who must estimate on brickwork and direct construction operations on which brick is used. All types of brick and brickwork are described, including commonly used structural terracotta, also various types of brick wall construction, boiler settings, chimneys, and minor paving such as ornamental driveways. No information on brick pavements as used on highway and city streets is given, nor is there anything on reinforced brickwork. Considerable space is devoted to mortars, cement and concrete.

Two Texts on Drawing

ENGINEERING DRAWING—By L. M. Sahag. 394 pp. The Ronald Press Co., New York. $2.75.

A MANUAL OF ENGINEERING DRAWING—By H. C. Hesse. 110 pp. The Macmillan Co., New York. $1.50.

Late in 1942 two new texts were added to the many books on engineering drawing that are available to instructors in engineering. In justification for his addition to the "many text books of merit", Prof. Sahag states that his purpose is "to offer the maximum of training in the minimum of space and time." To this end he has attempted to avoid too many elementary figures in classroom problem work, to make descriptions brief and to eliminate non-essential exposition, demonstrating theory by sufficient illustrations. Drawing problems are grouped in an 88-p. section at the back.

Prof. Hesse's book is designed especially for short defense courses and first-year college work. The 8x11-in. pages are reproduced by offset from the original typed manuscript and drawings, are spiral bound and perforated so that they can be torn out for use in loose-leaf notebooks.

Specification Data

PLUMBING PRACTICE AND DESIGN: Volume I—By Svend Plum. 308 pp. John Wiley & Sons, New York; Chapman & Hall, London. $4.50.

Data required by those who must design and prepare specifications for plumbing systems have been assembled from many sources and arranged in convenient form in this book. A large part is tabular matter, including extensive tables of pipes and fittings, both metal and earthenware. Accepted methods for setting plumbing fixtures of all kinds are shown diagramatically. Included is data on pumps used in building services, standpipes and hose connections, automatic sprinklers, compressors and vacuum pumps for cleaning systems. A valuable feature of the book is the tabulation of definitions of terms used in each chapter.

For Light Reading

KEEP 'EM CRAWLING—Earthworms at War, a new Alexander Botts book. By William Hazlett Upson. 339 pp. Farrar & Rinehart, Inc. New York. $2.

IT'S A CINCH, PRIVATE FINCH—By Sgts. Ralph Stein and Harry Brown. 90 pp. Whittlesey House, McGraw-Hill Book Co. New York. $1.50.

The two volumes are recommended especially to engineers of the Army, Navy or Marines, and to all others who enjoy a good laugh.

William Hazlett Upson takes his Earthworm Tractor super-salesman Alexander Botts into the war effort in a series of short stories made up of correspondence with the home-office. Not previously published in book form, these stories highlight the uses of tractors in the war effort as well as the contribution of the construction-machine industry to war machines.

Private Finch wanted to be somewhere else but Uncle Sam has him in the Army Corps of Engineers. According to the authors, his job in the day time is to dig ditches but his regular work comes at night—filling up the ditches. He also builds bridges—underwater. Mixed text and half—cartoons and text—the book is certain to get more readers in camp than a paper from home.

Miscellaneous Notes on Booklets and Reprints

A STUDY of the Controlled Materials Plan of the War Production Board has been prepared by the Research Institute of America, 1 Madison Ave., New York, as Research Institute Analysis No. 3, "TNT". Price, $2 a copy.

FLOOD FLOWS in the Sacramento River Near Rio Vista are given in a report of the California Department of Public Works, which includes the stage and frequency of flood flows and their relation to the bypass channels in the river and other flood-control works.

RECENT ARTICLES of significance on sanitation practice, reprinted from *Engineering News-Record*, are available in booklet form for free distribution. The articles deal with vacuum flotation, sanitation in Latin America, contact aeration, and a review of municipal water and sanitation developments.

WELDING METHODS that increase production are the subject of a series of articles published in *Steel* during 1942 which have been reprinted by the Lincoln Electric Co. in a pamphlet entitled "Factors Affecting Increased Welding Production". Interested persons can obtain copies from the Lincoln Electric Co. Cleveland, Ohio.

THE SANITATION MANUAL for land and air conveyances operating in interstate traffic, recently adopted by the U. S. Public Health Service, provides public health agencies and carriers with information upon which to base their procedures. The manual deals with sanitation of water supplies, milk and milk products, eating and drinking facilities, excreta disposal, refuse disposal and other items of sanitation. Apply to

(Continued on p. 124)

RITECURE

The Original Membraneous Concrete Curing Material

s Uniformity Assures onsistently Good Curing

HE shipment of RITECURE to one of the West Indies last winter did not er the slightest bit—except in gallonage om another shipment recently tagged Kentucky. Nor do successive shipments a single large job.

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CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

WATERWORKS IMPROVEMENTS ELK CITY, OKLAHOMA

OWNER: City of Elk City, Okla.; J. R. Willis, Tulsa, engr.

PROJECT: Waterworks improvements at Elk City, Okla., involving construction of 3,400-ft. steel pipe line crossing the North Fork of Red River. Pipe diameter is 14 in.

CONDITIONS: Contractor to furnish all materials except steel pipe, reinforcing and structural steel, and gate valve. Bids were also asked on relocation of 1,950 ft. of steel pipeline, and removal and storage of 2,800 ft. of 14-in. cast iron pipe line, but these items were deleted from the specifications in the final form. Time for completion: 90 days. Rail and highway transportation facilities available to Elk City. Wage rates are skilled labor, $1.25 per hour; semi-skilled, 75c.; and common, 50c.

BIDS: Two bids were received December 15, 1942, the contract low of $36,491 and $39,617.

LIST OF BIDDERS:

1. Sherman Machine & Iron Works, Oklahoma City, Okla. (contract) $36,491
2. Midwest Engineering and Construction Co., Tulsa, Okla. 39,617

Item	Quan.	Unit Prices (1)	(2)
1. Install 14-in. steel pipe line	3,400 l. f.	$8.80	$10.00
2. Class A concrete	85 c. y.	30.00	35.00
3. Class B concrete	36 c. y.	25.00	35.00
4. Install rein. and struct. steel	34,400 lb.	.09	.03
5. Install 14-in. gate valve with box	Lump Sum	25.00	350.00

CONCRETE OVERPASS, UTAH

OWNER: Utah State Road Commission, Salt Lake City; John S. Evans, Chairman.

PROJECT: Construction of concrete T-beam overhead crossing over Denver & Rio Grande Western Railroad tracks, concrete T-beam bridge over Jordan River, and concrete box culvert on 21st South St., between Main St. and Redwood Rd. in Salt Lake City. Railroad overhead crossing is 255 ft. long.

CONDITIONS: Contractor to furnish all materials and complete work in 170 working days. Rail and highway transportation facilities available. Wage rates are: skilled labor, $1.25 to $1.35 per hour; semi-skilled, 90c; and common, 75c.

BIDS: Five bids were opened December 29, 1942, ranging from the contract low of $132,976 to $186,783. Engineer's estimate $138,078.

LIST OF BIDDERS:

1. Gibbons & Reed Co., Salt Lake City, Utah (contract) $132,976
2. Young & Smith Constr. Co., Salt Lake City, Utah 135,465
3. George M. Carruth & Son, Evanston, Wyo 141,522
4. W. W. Clyde & Co., Springville, Utah 170,727
5. A. O. Thorn & Sons Constr. Co., Springville, Utah ... 186,783

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excavation for structures	525 c. y.	$3.00	$5.00	$5.00
2. Concrete, Class A	160 c. y.	35.00	42.00	34.40
3. Reinforcing steel	36,500 lb.	.09	.07	.08
4. Excav. for structures, overhead bridge	600 c. y.	3.50	3.00	2.00
5. Concrete, Class A	1,000 c. y.	35.00	38.00	40.00
6. Reinforcing steel	230,000 lb.	.09	.07	.08
7. Structural steel	29,000 lb.	.22	.25	.25
8. Concrete handrail	511 l. f.	4.00	7.00	6.00
9. Piles, treated	6,000 l. f.	2.20	2.00	2.30
10. Furnish pile driving equipmt.	Lump Sum	400.00	1,000.00	500.00
11. Electrical equipment	Lump Sum	200.00	500.00	[illegible]
12. 6 or 8-in. perf. corr. galv. metal pipe underdrains	200 l. f.	1.25	2.00	[illegible]
13. Excav. for structures, bridge over 20-ft. span	300 c. y.	3.50	5.00	[illegible]
14. Concrete, Class A	400 c. y.	35.00	38.00	[illegible]
15. Reinforcing steel	90,000 lb.	.09	.07	[illegible]
16. Structural steel	1,700 lb.	.22	.25	[illegible]
17. Concrete handrail	375 l. f.	4.00	7.00	[illegible]
18. Concrete piles	1,400 l. f.	8.50	8.00	[illegible]
19. Test pile	1 ea.	800.00	800.00	[illegible]
20. Furnish pile driving equipmt	Lump Sum	400.00	700.00	[illegible]
21. Remove existing structures	Lump Sum	4,000.00	4,000.00	[illegible]
22. 6 or 8-in. perf. corr. galv. metal pipe underdrains	60 l. f.	1.25	2.00	[illegible]
23. 6 or 8-in. perf. corr. galv. metal pipe	34 l. f.	1.25	2.00	[illegible]

HIGHWAY, NEW JERSEY

OWNER: New Jersey State Highway Dept., Trenton.

PROJECT: Construction of Port Street Access Road bet[ween] Route 25 and Doremus Avenue, Newark, Essex County, N[J]. Pavement, approximately 0.764 miles long, is of maca[dam]. Project involves all necessary excavation, topsoiling, b[ase] course, drainage structures and bridge.

CONDITIONS The state highway department is constru[cting] project for Bureau of Public Roads. Rail, highway and w[ater] transportation facilities available. Contractor to furnish materials except the 12-in. cast iron pipe. Existing castings to be used in construction of manholes. Priority rating [A-1]. All labor to be employed from lists of U. S. Employment S[er]ice in Newark. Minimum wage rates are: skilled labor, $[1] per hour; semi-skilled, 65c.; and common, 50c. per hour.

BIDS: Four bids were received January 13, 1943, ranging [from] the contract low of $221,868 to $308,209.

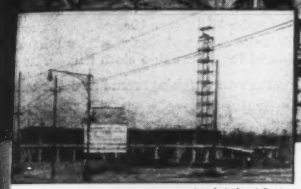
LIST OF BIDDERS:

1. H. L. Harrison & Son, Inc., Newark, N. J. (contract) $22[1,868]
2. N. J. Asphalt & Paving Co., Jersey City, N. J ..... 22[5,]
3. S. B. Miller Contracting Corp., Long Island City, N. Y. 27[1,]
4. Franklin Contracting Co., Newark, N. J ..... 30[8,]

Item	Quan.	Unit Prices (1)	[illegible]
1. Removal of swamp sod	1,819 c. y.	$1.25	[illegible]
2. Roadway excavation, earth	447 c. y.	1.10	[illegible]
3. Borrow excavation	63,618 c. y.	.97	[illegible]
4. Ditch excavation	207 c. y.	1.50	[illegible]
5. Subgrade	200 s. y.	.20	[illegible]
6. 4-in. topsoiling	9,736 s. y.	.35	[illegible]
7. Macadam base course	4,289 s. y.	.75	[illegible]
8. Pavement, type T, bottom course	710 ton	9.75	[illegible]
9. Concrete base course, 8-in. thick	200 s. y.	3.60	[illegible]
10. Modified penet. macadam intermediate course, 3-in. thick	4,289 s. y.	.80	[illegible]
11. Pavement, type T, top course	590 ton	9.75	[illegible]
12. 12-in. conc. or clay sewer pipe	93 l. f.	2.80	[illegible]
13. 18-in. conc. or clay sewer pipe	1,605 l. f.	4.15	[illegible]
14. 24-in. conc. or clay sewer pipe	1,794 l. f.	5.40	[illegible]
15. 12-in. cast iron pipe (furnished)	32 l. f.	10.00	[illegible]
16. Manholes, using existing castings	2 ea.	150.00	[illegible]
17. Inlets, type B and D, wood tops	15 ea.	145.00	[illegible]
18. Reset inlet heads	2 ea.	20.00	[illegible]
19. White concrete vertical curb, 7x19-in.	3,809 l. f.	1.25	[illegible]
20. Reset granite curb	751 l. f.	1.35	[illegible]
21. Concrete header, 12x12-in	85 l. f.	1.15	[illegible]
22. Concrete header, 12x22-in	200 l. f.	1.55	[illegible]
23. Class C concrete	1 c. y.	30.00	[illegible]
24. Wood guard fence	2,033 l. f.	1.65	[illegible]
25. Stone ballast	50 ton	4.00	[illegible]
26. Grouted rubble slope protection	21 s. y.	3.50	[illegible]
27. Type B and D inlets, concrete tops	2 ea.	135.00	[illegible]
28. Concrete island pavement, 7-in. thick	197 s. y.	3.40	[illegible]
29. White conc. sloping curb, 15x8-in.	396 l. f.	1.50	[illegible]
30. Earth excav., subsurface structures	100 c. y.	5.00	[illegible]
31. Foundation excavation, bridge	432 c. y.	15.00	[illegible]
32. Class B concrete, bridge struct	284 c. y.	36.35	[illegible]
33. Class C concrete, bridge struct	831 c. y.	25.30	[illegible]
34. Concrete balustrade	525 l. f.	8.00	[illegible]
35. Structural steel	252,900 lb.	.05	[illegible]
36. Reinforcing steel, structures	50,350 lb.	.09	[illegible]
37. Flooring in cofferdams	3 M bm.	200.00	[illegible]
38. Treated timber	48 M bm.	200.00	[illegible]
39. Timber piles	4,200 l. f.	1.00	[illegible]
40. Treated timber piles	7,080 l. f.	1.60	[illegible]
41. Untreated timber	73 M bm.	240.00	[illegible]

ANOTHER CORBETTA EXAMPLE *of* GETTING THINGS DONE!

Brooklyn Navy Yard Defense Housing Project
Federal Work Agency in cooperation with
New York City Housing Authority



Mid-July 1941

Late-July 1941

Early-August 1941

FROM EXCAVATION TO NAVY OCCUPANCY IN 143 WORKING DAYS

New York City's first defense housing project! A 13-story, reinforced-concrete shore home for U. S. Navy personnel. Corbetta-erection of all 13 floor structures . . . (each 11,500 sq. ft., with 125 column supports) . . . achieved in 37 working days! In a total of 143 working days this Corbetta-completed building was ready for navy families to stream in and drop anchor! Back of this accomplishment was the CORBETTA "Know-How" — the experience gained from their previously constructed notable housing projects.

CORBETTA CONSTRUCTION COMPANY, INC.

FOUNDED UPON "GETTING THINGS DONE"

EXECUTIVE OFFICE: 220 EAST 42nd STREET, NEW YORK, N. Y.

OMA • NEBRASKA • WEST VIRGINIA • PENNSYLVANIA • OHIO • MARYLAND • DELAWARE • NEW JERSEY

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

CONSTRUCTION wage rates provide the most important price change in the construction material list in April. Rates for most of the trades listed in *ENR* for Seattle are up 6.5c. per hour. In Los Angeles the carpenters' rate is down 15c. per hour, and hoisting engineers are off 12.5c., but rates for structural ironworkers and common labor are 12.5c. higher. Hoisting engineers' rate in Atlanta which formerly ranged from $1.00 to $1.25 is now $1.25. The New Orleans common labor rate for heavy construction is 10c. per hour higher and is now 75c.

Paving asphalt climbs 50c. per ton in New Orleans [illegible] and $7.46 per ton in Seattle. Southern pine is up in Cleveland, and spruce [illegible] higher in Memphis. Wood piling is 2c. per linear foot higher in New York [illegible] rail delivery; barges are not available for water delivery. Common [illegible] is down $1 per M in Kansas City. Elimination of heating charge [illegible] ready-mixed concrete drops the M[illegible] apolis ready-mixed concrete from $7.60 to $7.10 per [illegible] yd., but the New York price is up. Cement, aggregates, structural and reinforcing steel are unchanged from the previous month's quotation.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT			SAND AND GRAVEL			CRUSHED STONE		CRUSHED SLAG		CONC
	Per bbl., carload lots, including 40c. per bbl. for bags, cash discount not deducted			Per ton, carload lots			Per ton, carload lots		Per ton, carload lots, f.o.b. plant		Ready-M 1:2:4
	Cloth Bags *a*	Paper Bags	Bulk	Gravel[1] 1½ in.	Gravel ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	1:2:4 mix
Atlanta	$2.77	$2.52	$2.47	$1.79	$1.89	$1.99	$1.79	$1.89	$1.59	$1.69	$8
Baltimore	2.33	2.08	1.88	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	8
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	8
Boston	2.75*b*	2.40*b*	2.30	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	....	....	9
Chicago	2.70	2.45	2.30	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	8
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	....	....	8
Cleveland	2.40	2.15	....	1.70*i*	1.70*i*	1.60*i*	1.70*i*	1.70*i*	1.75*i*	1.75*i*	8
Dallas	2.52	2.27	2.07	1.50*p*	1.70*p*	1.10*p*	1.69*p*	1.79*p*	....	....	8
Denver	3.08	2.88	2.68	1.20	1.40	1.25	1.65	1.75	1.00	1.00	8
Detroit	2.40	2.15	2.00	1.40	1.40	1.20	1.63	2.00	2.20‡	2.45‡	8
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	8
Los Angeles	2.80*g*	2.20*g*	....	1.30	1.30	1.15	1.30*f*	1.30*f*	....	....	8
Minneapolis	2.90	2.65	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	8
Montreal	....	1.95*rs*	1.79*rs*	....	....	1.30‡*t*	1.05‡*ct*	1.15‡*ct*	....	....	8
New Orleans	2.41	2.16	1.96	1.65	1.65	.90	....	....	....	....	9
New York	2.66‡	2.41‡	....	1.60*de*	1.60*de*	.90*de*	1.70*de*	1.80*de*	....	....	8
Philadelphia	2.33	2.08	1.88	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	8
Pittsburgh	2.44	2.19	1.99	1.40‡	1.40‡	1.70‡	2.25‡	2.25‡	1.50	1.50	8
St. Louis	2.80	2.52	....	1.75‡	1.50‡	1.25/1.50‡	1.10*h*	1.10*h*	.75*gw*	.75*gw*	8
San Francisco	.... *u*	2.22	1.92	1.36	1.36	1.36	1.46	1.46	....	....	8
Seattle	2.95*o*	2.75*o*	....	1.00*o*	1.00*o*	1.00*o*	2.00*o*	2.00*o*	....	....	8

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Plus municipal tax. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* Up to 200 cu.yd. *m* 50c off for cash. *n* 2% o 2% off for cash. *p* 10c. per ton off cash 15 days. *r* 10c. per bbl. off s 8% sales tax included. *t* 8% sales tax not included. *u* Price v 20c. per bbl. discount; 20c. allowed for returnable cloth bag. *w* N

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer c 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., no

	Bagged	Bulk		Bagged	Bulk		Bagged
Buffington, Ind.	$1.70	$1.65	Ironton, Ohio	$1.60	$1.55	Richard City, Tenn.	$1.8
Dallas, Tex. (Inc. 10c. tax)	1.85	1.80	Limedale, Ind.	1.70	1.65	Steelton, Minn.	1.8
Hannibal, Mo.	1.70	1.65	Norfolk, Va.	1.75	1.70	Universal, Pa.	1.6
Hudson, N. Y.	1.75	1.70	Northampton, Pa.	1.55	1.50	Waco, Tex. (Plus 10c. tax in Tex.)	1.7
Independence, Kans.	1.70	1.65	North Birmingham, Ala.	1.70	1.65	Montreal (8% sales tax incl.)	1.6
						Discount 10c per bbl. 20 days	

PAVING BRICK, BLOCKS, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICKS AND BLOCKS			PAVING ASPHALT		ASPHALT BINDERS—FLUXES		CUTBACK ASPHALT		ROAD OILS	ASPHALT EMULSION
	Granite per M. lots of 50,000 4x4x8 in.	Brick per M. 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Per ton, less than 80 penetration Tank car	Drums	Per gal., 80–300 penetration Tank car	Drums	Per ton Tank car	Drums	Per gal. Tank car	(Quick-break Per ga Tank car
Atlanta	$23.00	$39.35	$2.25	$18.40*e*	$24.62*e*	$0.0787*e*	$0.1309*e*	$0.0876*he*	$0.1348*h*	$0.0676*e*	$0.0826
Baltimore	150.00‡	48.00	80.00*m*	15.00*r*	21.00*r*	.06*r*	.09*r*	13.00*r*	23.00*r*	.065*r*	.07*r*
Birmingham	....	32.00*j*	....	17.95	....†	.0747	....†	.0834*h*	....†	.065	.09
Boston	80.00	55.00	3.75	14.20	20.00	.06	.09	.065*h*	.115*h*	.065	.09‡
Chicago	150.00	55.00	1.80/2.00*d*	14.00	22.50	13.00*q*	21.50*q*	.0575*h*	.15*h*	.05*n*	.09/.10*n*
Cincinnati	112.00	37.50	....	16.40	....	.085	....	12.25	....	.07	.085
Cleveland	118.00	37.50	2.25	19.00	23.50	.10	.11	.09*h*	.105	.08	.10
Dallas	....	36.00	....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07
Denver	....	27.50	....	....	....	....	....	....	....	....	....
Detroit	....	37.50	....	15.10*f*	22.60*f*	.0725	.1262	.0718*h*	.119*h*	.067	.0725
Kansas City	....	40.00	....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	11
Los Angeles	....	50.00	....	9.00*b*	23.00	9.50*bq*	24.00*bq*	9.50*b*	....	.025	072
Minneapolis	....	....	2.30*d*	....	27.70	....	.126	....	32.64	....	....
Montreal	....	....	....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	135*k*
New Orleans	....	....	....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	....	.080
New York	....	70.00	....	17.40	24.20*p*	14.00	....	.0725*h*	.1325*hp*	....	.0725*a*
Philadelphia	130.00	58.00	4.06	15.00	....	14.00	....	.065*h*	....	....	14.00*q*
Pittsburgh	135.00	38.75	....	....	....	....	....	....	....	....	....
St. Louis	....	37.00	....	15.00*n*	21.00*n*	14.00*qn*	20.00*qn*	.065*hn*	.11*hn*	.05*n*	.09*n*
San Francisco	....	70.00	....	9.50	18.75	9.50*qr*	18.00*qr*	10.00	17.50*r*	9.50*q*	.0525
Seattle	....	60.00*c*	....	10.90*i*	19.40*i*	....	19.00*qi*	10.00*i*	....	9.50*i*	.0525*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8½ in. *d* 2½ in. 12-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3x3½x8½ in. *k* Tax included. *m* Per thousand. † Available on priority only and quoted specially. *n* Septe price, none later available. *p* No steel drum shipments except to arme *r* February 1943 prices, none later available.

Now—a proved substitute for rubber in

TANK LINING

and all corrosion-resistant service

CORROSION RESISTANCE OF TYGON

The following list defines the general resistance of TYGON to corrosive attack. This list was prepared for temperatures up to 150 degrees F.

Inorganic Acids, except fuming Nitric	Satisfactory
Inorganic Salts	Satisfactory
Most Organic Acids, except Glacial Acetic	Satisfactory
Pickling Solutions	Satisfactory
Alkali Solutions	Satisfactory
Plating Solutions	Satisfactory
Alcohol (Pure and Denatured)	Satisfactory
Petroleum Oils	Satisfactory
Gasoline	Satisfactory
Benzol	Unsatisfactory
Turpentine	Swells
Linseed Oil	Satisfactory
Vegetable Oils	Satisfactory
Disinfectants (fly spray)	Satisfactory
Lacquers	Unsatisfactory
Ether	Hardens
Soaps	Satisfactory
Ferric Chloride	Satisfactory
Floor Wax and Polish	Satisfactory
Creosote	Unsatisfactory
Chlorinated Solvents in general	Unsatisfactory
Tetrachloride	Unsatisfactory
Chloroform	Unsatisfactory
Food Products	Satisfactory*

*Special Tygon compounds are required.

—T. M. United States Stoneware Company

TO all industries employing organic or inorganic acids, alkalies and salt solutions, Goodyear now offers a new synthetic resinous tank lining which resists these corrosive substances as effectively as rubber.

This new lining is TYGON. It is made for Goodyear by the United States Stoneware Company and has a record of eight years' successful application in all types of chemical service.

TYGON can be applied to metals, wood and concrete. It does not require vulcanizing, hence there is no restriction on size of units in which it can be used. It is not brittle nor subject to mechanical shock, does not oxidize or chemically deteriorate with age. It can be easily repaired in the field if damaged.

For complete information on this time-tested corrosion-resistant, write Goodyear, Akron, Ohio or Los Angeles, California.

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¼-in. billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle Bars	Std. Tie Spikes *c*	Plates *c*
Birmingham	$2.10	$2.15	$3.75	$2.55	.....	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15
Chicago	2.10	2.15	3.75	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15
Pittsburgh	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15
Cleveland	2.10	2.15	3.75	2.55	.....	.....	.....	.....	.....	.....	.....
Youngstown	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....
Detroit	.....	2.27‡	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gulf ports	2.47*a*	2.52*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....
Pacific ports	2.75*a*	2.80*a*	.....	.....	2.95*a*	.....	.....	.....	.....	.....	2.30

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone; Steelton, Pa., spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18.

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¼ in., base price 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq.yd., carload lots Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq.yd., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No 8 & 12 wires	6x6 in. No. 6 & 6 wires Per sq. yd.	SHEET PILING Per 100 base
Atlanta	$2.34	$2.39	$2.39	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$0.1719	$3.0
Baltimore	3.70	2.90	2.75	.....	.10	22.50	24.50	1.70	1.27	.1611	3.0
Birmingham	2.10*a*	2.15	2.15	.02½	10	19.00	21.00	1.80	1.34	.1701	
Boston	3.85	3.51	3.36	$20 C.L.	.10	18.50	29.50	1.76	1.31	.1656	2.7
Chicago	2.10*a*	2.15	2.15	.03	.05	21.50	23.50	1.67	1.25	.1575	2.6
Cincinnati	3.68	2.53*cd*	2.53*cd*	.....	.05	19.50	21.50	1.66	1.25	.1566	
Cleveland	2.10*a*	2.15	2.15	.02½	.10	19.50	21.50	1.66	1.25	.1566	
Dallas	4.25	3.17	3.17	.....	....	25.00	27.50	1.93	1.42	.1827	
Denver	4.35	3.95	3.85	.....	....	26.50	28.50	1.97	1.45	.186	
Detroit	3.65‡	2.52‡	2.52‡	.....	.10	25.00	28.00	1.68	1.26	.1584	2.9
Kansas City	4.00	2.64*cd*	2.64*cd*	.0	.05	19.60	23.60	1.78	1.33	.1683	2.9
Los Angeles	3.65*f*	2.575	2.425	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.0
Minneapolis	3.80‡	2.75	2.75	.0	.10	25.00	27.00	1.80	1.34	.1701	2.7
Montreal	4.00*i*	2.90*i*	2.80*i*	.....	....	26.00*hij*	33.00*hij*	2.56*i*	3.14*i*	.268*i*	
New Orleans	4.40	2.52	2.52	.05	.10	21.50	23.50	1.82	1.35	.1715	2.7
New York	3.75	2.76*e*	2.76*e*	.....	.15	17.50	19.50	1.76	1.32	.1665	2.7
Philadelphia	3.65	3.85	....	.....	....	19.50	21.50	1.71	1.28	.1611	2.7
Pittsburgh	2.10*a*	2.15	2.15	.02½	.10	23.00	26.50	1.59	1.20	.1503	2.4
St. Louis	3.69	2.7575	2.7575	.0	.05	28.00	34.00	1.69	1.27	.1602	2.7
San Francisco	4.35	2.825	....	.02½	.10	21.00	24.50	1.93	1.42	.1827	3.0
Seattle	2.75*e*	2.50*e*	....	.....	....	34.50	38.50	1.93	1.42	.1827	2.9

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. * High scrap steel prices cut former 15c. differences between billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* August 1942 price; not on market.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s.	ASTM 24 in.,	C13–35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14–35 24 in.	WROUGHT STEEL PIPE Full standard weight, *k* 1 to 3 in., Black %	Butt Weld 3½ to 6 in., Galv. %	Black %	Lap
Atlanta	$49.66	$0.26*b*	$0.468*bc*	$1.8525	$4.68*c*	$85.00	$128.00	$0.45	$1.642	48.2	54.2	59.7	53
Baltimore	53.00	.35	.60	2.65	7.25	160.00	200.00	.50	1.75	65.5	57.5	63.0	54
Birmingham	45.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.70	62.2	54.2	59.7	53
Boston	55.40	.26	.463	2.07	5.85	140.00	.....	.60	.....	....	....	....	
Chicago	54.33	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	66.0	55.0	64.5	53
Cincinnati	53.27	.231	.4455	1.80	5.125	105.00	170.00	.60	1.70	57.1	43.4	54.0	39
Cleveland	54.75	.224	.432	1.80	5.125	81.00	125.00	.36	1.40	68.5	57.5	66.0	54
Dallas	56.43	.31	.58	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	48
Denver	61.56	.29†	.52†	2.16†	.....	130.00	240.00	.50	1.50	58.4	50.4	55.7	47
Detroit	54.75	.245	.4725	1.935	5.14	82.50	131.25	.35	1.50	57.7	44.0	54.8	49
Kansas City	55.73	.315	.39	2.20	5.86	140.00	260.00	.45	1.60	35.8	46.3	46.0	36
Los Angeles	68.40	.282†	.508†	2.034†	5.085†	115.50	192.50	1.00	2.00	59.6	51.6	57.0	48
Minneapolis	59.00	.275†	.495†	1.98†	5.14†	.....	.....	.90	2.10	64.0	53.0	60.5	49
Montreal	60.00	.85	1.50	5.25	8.50*e*	45.00*m*	64.00*m*	.48*m*†	1.92*m*†	....	....	....	
New Orleans	51.78	.26	.48	1.69	.....	150.00	220.00	.40	2.10	62.4	54.4	58.8	50
New York	52.40	.322	.621	2.43	6.15	.....	.....	.60	1.40	64.7	53.7	62.2	50
Philadelphia	51.00	.28	.54	2.30	6.75	150.00	225.00	.45	1.75	56.4	42.6	53.3	38
Pittsburgh	56.00	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54
St. Louis	52.84	.28	.504	2.016	4.50	85.00	220.00	1.00*j*	2.15*k*	56.4	42.6	52.5	38
San Francisco	68.40	.3625*d*	.6525*d*	2.61	6.52	115.50	192.50	.58	2.34	46.0	32.0	42.0	27
Seattle	70.20	.375	.675	2.70	6.75	84.00	187.50	.51*f*	1.44*f*	....	....	....	

‡ Delivered. †F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N.J. (base) $49.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.; ⅛ in., 8½c.; ¼ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. 3 percent tax on transporation costs not included.

‡ Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 2 in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, galv. 14½; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76–37. *k* Reinforced; spec. C 75–37. *l* Plus sales tax. *m* Tax included.

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LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Fox. (Prices in Bold Face)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD
	All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)											
	1x6 S&S	1x8 S&S	2x4 S&S	2x6 S&S	2x8 S&S	2x10 S&S	3x12 R/A	6x12 R/A	12x12 R/A	2x12 R/A	12x12 R/A	
Atlanta	**$32.00**	**$32.00**	**$29.00**	**$28.00**	**$28.00**	**$31.50**	**$46.00**	.....	.....	$54.00	$62.00	
Baltimore	**40.00**	**42.00**	**40.00**	**40.00**	**41.00**	**44.00**	**60.00**	.....	.....	110.00	115.00	
	45.00	*46.00*	*52.00*	*52.00*	*52.00*	*52.00*	*68.00*	*$72.00*	*$72.00*	.....	.....	
Birmingham	**34.50**	**36.50**	**32.00**	**32.00**	**34.00**	**34.00**	**53.00**	**53.00**	**56.00**	.....	.....	
[1]	37.50	37.50	37.00	37.00	37.00	43.00	65.00	.....	.....	67.50	70.00	
Boston	‡*	.....	50.00[2]	55.00[2]	.....	.....	.....	.....	.....	.....	.....	
	‡* *45.00*	*45.00*	*50.00*	*55.00*	*60.00*	*70.00*	*75.00*	*80.00*	*80.00*	.....	.....	
Chicago	**42.00**	**43.00**	**41.00**	**40.00**	**41.00**	**42.50**	**60.00**	.....	.....	80.00	95.00	
	46.00	*46.00*	*47.50*	*47.00*	*47.00*	*48.00*	*57.00*	*56.50*	*58.00*	.....	.....	
Cincinnati	**41.00**	**42.50**	**39.00**	**40.50**	**42.00**	**43.00**	**53.00**	.....	.....	65.00	68.00	
	.....	.....	.....	.....	.....	.....	*55.50*	*55.50*	*55.50*	.....	.....	
Cleveland	**42.50**	**42.50**	**52.50**	**51.00**	**51.00**	**54.00**	**78.00**	70.00	70.00	.....	.....	
Dallas	e **39.50**	**40.50**	**39.50**	**38.00**	**38.50**	**39.50**	**53.00**	**53.50**	**53.00**	78.00	83.00	
Denver	‡ 54.00[3]	52.00[3]	55.00[3]	55.00[3]	55.00[3]	56.00[3]	59.00[3]	*73.00*	*79.00*	.....	.....	
Detroit	**44.00**	**44.00**	**44.00**	**43.50**	**44.00**	**46.00**	**60.00**	.....	.....	53.00	63.00	
	.....	.....	.....	.....	.....	*51.50*	*55.00*	*60.00*	*60.00*	.....	.....	
Kansas City	**50.00**	**55.00**	**52.00**	**52.00**	**52.00**	**55.00**	**65.00**	.....	.....	75.00	85.00	
	50.00	*55.00*	*52.00*	*52.00*	*52.00*	*55.00*	*65.00*	*80.00*	*80.00*	.....	.....	
Los Angeles	a *55.00*	*55.00*	*53.00*	*53.00*	*51.00*	*51.00*	*57.00*	*65.00*	*56.00*	.....	.....	
Minneapolis	b 49.00[4]	49.00[4]	.....	.....	.....	.....	.....	.....	.....	.....	.....	
	‡ *53.00*	*53.00*	*53.00*	*52.00*	*52.00*	*53.00*	*59.00*	*61.00*	*61.00*	.....	.....	
Montreal	[17] *52.00*	*55.00*	*48.00*	*52.00*	*54.00*	*60.00*	.....	.....	.....	200.00	200.00	
	42.50	*42.50*	*45.25*	*47.25*	*48.25*	*46.75*	*50.75*	*50.75*	*50.75*	.....	.....	
New Orleans	**31.50**	**31.50**	**33.75**	**31.75**	**34.00**	**35.00**	**48.00**	.....	.....	69.00	69.00	
	31.00	*31.00*	*33.00*	*31.00*	*34.00*	*32.00*	*33.00*	.....	.....	.....	.....	
New York	‡ **50.00**	**51.00**	**51.00**	**50.00**	**51.00**	**54.00**	**62.00**	.....	.....	120.00*f*	125.00*f*	
	‡	.....	*65.00i*	*65.00i*	*65.00i*	*65.00i*	[Range from $75 to $95]			.....	.....	
Philadelphia	**50.75**	**50.75**	**51.75**	**50.00**	**50.00**	**52.75**	**70.00**	.....	.....	110.00	107.75	
	.....	.....	*65.00*	*65.00*	*65.00*	*65.00*	*67.50*	*$75 to $95*	*$75 to $95*	.....	.....	
Pittsburgh	**50.80**	**53.20**	**62.75**	**55.00**	**60.85**	**62.50**	**76.25**	.....	.....	.....	.....	
	69.20	*68.10*	*66.10*	*65.30*	*65.20*	*65.65*	*88.75*	*88.75*	*88.75*	.....	.....	
St. Louis	c **51.00**	**51.00**	**49.00**	**48.00**	**49.00**	**52.00**	**66.00**	*72.00*	*72.00*	84.00	71.00	
San Francisco	f *35.50*	*35.50*	*37.00*	*37.00*	*36.50*	*36.50*	*40.50*	*49.50*	*49.50*	.....	.....	
Seattle	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*40.00*	*40.00*	*40.00*	.....	.....	

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax. * Prices for truck delivery; no longer quoting carload lots f. o. b. city.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 3-ply or 5-ply, 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. ... Seattle base price on ¼", $86.50; on ¾", $95.30; price includes oiling and ... ing charges. For other centers add rail freight increment from table ... size. For resin dipped treatment, add $10.50 per M. *g* Lower rate ... shipment. *h* 50,000 lb. minimum. *i* Ranges from $65 to $69.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*	
	A quality	B quality		
Atlanta	75%	75%	$0.15	
Baltimore	78%	79%	.15	
Birmingham	76%	76%	.105	
Boston	77%	78%	.15	
Chicago	77%	77%	.15	
Cincinnati	71-10%	71-10%	.15	
Cleveland	77-10%	77-10%	.19	
Dallas	76%	76%	.1625	
Denver	76%	76%	.155*e*	
Detroit	77%	77%	.1575	
Kansas City	76-10%	76-10%	.155	
Los Angeles	86%*d*	88%*d*	.1575	
Minneapolis	77%	77%	.155	
Montreal	40-5%‡	47%‡	.1675†	
New Orleans	70%	75%	.16	
New York	81%	82%	.22*f*	
Philadelphia	78%	79%	.15	
Pittsburgh	79%	79%	.1225	
St. Louis	76-10%	76-10%	.155	
San Francisco	66-15%	73-15%	.155	
Seattle	75%	75%	.1575†	

Price of 60% Ammonia Gelatin is $0.01 per lb. higher than 40%

a Disc. from list Sept. 1939. *b* Also less 6% tax exemption. *d* Discount from jobbers list Sept. 15, 1928. ‡ Plus sales tax.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal Street, add delivery charge of $6.00 per trip. † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.11 -.1175	.135 -.1475	.155 -.1675
Rocky Mtn. States	.11 -.1225	.135 -.1525‡	.155 -.1725‡
Pacific N. W. States	.1075-.12	.1375-.15	.1575-.17
Pacific S. W. States	.1050-.1125	.135 -.1425	.155 -.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES—F.O.B.

PILES

Prices per linear foot, pine, with bark on, f.o.b. New York; delivered ... barge 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Short lots Range
12 in. at butt	6 in.	30 to 50 ft	...
12 in.—2 ft. from butt	6 in.	50 to 59 ft	...
12 in.—2 ft. from butt	6 in	60 to 69 ft	...
14 in.—2 ft. from butt	6 in.	50 to 69 ft	...
14 in.—2 ft. from butt	6 in.	70 to 79 ft	...
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	...
14 in.—2 ft. from butt	5 in.	85 to 89 ft.	...

RAILWAY TIES

Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x6"x8'6" Untr.	7"x6"x8'6" Tr.
Boston	Oak	$1.50	.....	$2.00	
	Pine	2.00	$3.00*a*	3.00	
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	
	Mixed Oak	1.71	2.59	2.42	
Birmingham	White Oak	1.00	1.60*a*	1.30	
	Southern Pine	....	....	....	
Chicago	Red Oak	....	2.19*a*	.....	2.87
	Southern Pine	....	....	....	
Los Angeles	Douglas Fir	1.10	1.75*a*	1.60	
Philadelphia	Red Oak	....	2.10*a,g*	....	
St. Louis	White Oak	1.65*	....	1.90*	
	Red Oak	1.55*	2.15*a**	1.90*	
	Sap Pine or Cypress	1.35*	....	1.70*	
San Francisco	Douglas Fir	1.15*bef*	....	.....	
Montreal	Birch or Maple	.85	.95	....	†

Tr.—Treated; Untr.—Untreated. *a* Creosoted *b* 6"x8"x8'6". *e* ... cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. * September ... price, none later available. *g* January price, none later available.

CHEMICALS

Water, sewage treatment road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb.	$2.50-
Chlorine cylinders, liquid, per lb. delivered	
Calcium chloride, 77-80%, flaked, in 100-lb. paper bags, delivered, per ton	18.50-35
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	
Soda ash, 58%, in paper bags, per 100 lb. dense	
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00-25
Sulphate of copper, in bbl., per 100-lb.	5.15-

SMOOTH runways for smooth landings

LIKE BUSY HIGHWAYS . . . airport runways and taxiing surfaces have to be kept free of snow and ice throughout long northern winters!

This necessity has created a serious problem for both contractor and operator . . . because constant freezing, thawing, and the action of de-icing agents tend to destroy the surface of concrete, causing it to crack and scale.

VINSOL*-TREATED CEMENT RESISTS SCALING

Vinsol*-treated Cement Provides Answer!

Experiences of leading cement companies, highway departments, and engineering consultants show that Vinsol-treated cement resists scaling under the most severe weather and de-icing conditions. When Vinsol-treated cement has been laid side by side with normal portland cement, it has shown no tendency to scale, while the normal portland has scaled right up to the separation joints!

Contractors Enthusiastic!

Furthermore, contractors using Vinsol-treated cement report that it saves time and money in laying. Not only is it easier and quicker to spread but it is faster to finish. Because there is less bleeding and segregation, crews are able to work closer to the mixer and thus keep up to schedules.

Ask Your Cement Supplier!

Your supplier probably has Vinsol-treated cement with full instructions for its use. We have published a 44-page compilation of articles prepared by engineering authorities. Everyone working with cement should read this booklet, "Better Roads Ahead." Fill out and mail the coupon below for your copy.

*Reg. U.S. Pat. Off.

Specify Vinsol-treated Cement for Longer Surface Life

NAVAL STORES DEPARTMENT
HERCULES POWDER COMPANY
INCORPORATED
966 MARKET ST., WILMINGTON, DELAWARE

Gentlemen:
Please send me a copy of 44-page book, Better Roads Ahead, telling the complete story of Vinsol treated cement.

Name_____
Company_____ Title_____
Address_____
City_____ State_____
LL-92

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE—PARTITION—SCORED			STRUCTURAL CLAY TILE—LOAD BEARING—SCORED			BRICK		LIME	
	Per M. lots of 2,000 pieces or over,			Per M. lots of 2,000 pieces or over,			Per M. in quantity.		Per ton,	
	3x12x12 in.	4x12x12 in	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	In paper Common Hydrated
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$250.00	$13.50	$18.04	$26.64	$15.04
Baltimore	84.00	90.00	170.00	200.00	260.00	320.00	15.00k	19.00k	18.00	13.00
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64
Boston	89.35a	93.30a	178.70a	202.50	271.80	308.20	16.50i	19.50i	17.50†	12.50†
Chicago	72.00	77.00	145.00	197.00	243.00	278.00	12.50	13.50	17.00	15.00
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	17.50	17.50	15.50	15.00
Cleveland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	15.75j	13.25j
Dallas	62.50	67.50	135.00	162.00	212.50	263.50	13.50i	15.00i	19.00	12.00
Denver	84.80	95.40	153.70	178.20	212.00	227.90	14.50	17.00	25.00f	17.00j
Detroit	86.05	91.80	172.10	213.00	268.00	330.00e	17.50	18.00	18.00	15.00
Kansas City	67.00	69.00	89.00c	128.00	163.00	189.00	14.50	15.00	19.32	13.00
Los Angeles	73.50†r	89.50†r	128.00c†r	210.00†r	368.00†r	460.00†r	13.50	15.00	16.50	11.50
Minneapolis	81.00b	86.40b	146.90b	.....	177.00b	246.00b	13.60	15.60g	21.00	16.00
Montreal	99.10a	105.65a	154.75a	101.65at	154.75au	155.25	24.10†u	27.25†u	24.60u	18.00u
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08
New York	78.40	83.60	115.00c	193.30h	238.80h	295.60h	15.00	.....	20.00	14.00
Philadelphia	90.00	97.70	183.20	197.10	243.20	301.10	17.00	20.00	15.75	9.00
Pittsburgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40
St. Louis	67.00	95.00	130.00	190.00	244.00	290.00	18.00	17.00	22.00	18.00
San Francisco	84.00	94.50	225.00	.....	.....	.....	17.50	22.00	20.00	20.00
Seattle	115.00	125.00	230.00	.....	.....	.....	20.00f	21.00f	20.00s	20.00s

† F.o.b. load bearing. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in. *d* Not *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days. *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. Warehouse only. *j* LCL. *k* $1.00 discount if paid in 10 days. *l* Lump *n* Per sack 100 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag *s* 2% discount for cash. *t* 5½x8x12. *u* 8% sales tax included

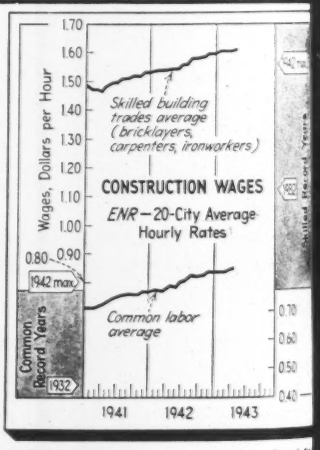
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD	WHITE LEAD	READY-MIXED PAINT			ROOFING SUPPLIES			Carload lots f.o.b. factory—
	Per 100 lb. in. 600-lb. (Approx.) bbl. Dry *a*	Per 100 lb. in oil	Per gal., drums Graphite *b*	Aluminum *b*	Ferric Oxide *d*	Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb	Tar felt, per 100 lb.	Asphalt coating per gal.
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40
Birmingham	10.25	14.125	2.35	3.50r	1.98r	2.04	1.97	1.97	.32
Boston	10.00	13.75	1.60	....	2.40	2.12‡	1.72h‡	1.72h‡	.50‡
Chicago	10.00	13.75	....	....	....	1.75hf	1.74hf	1.82hf	.33f
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39h	2.39h	.36
Cleveland	10.00	13.75	2.10	4.80	1.95	1.93	1.83h	1.83h	.35
Dallas	10.00	14.50	1.88	2.11n	1.05l	1.75h	1.66h	1.66h	.35
Denver	10.50	14.25	1.65	....	.27l	2.45	3.15	3.15	.35
Detroit	10.00	13.75	1.75	3.00	1.60	2.10	2.06	2.06	.35
Kansas City	10.00	13.875	2.39g	2.55gr	2.16gn	2.10	2.30	2.30	.28
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45
Minneapolis	10.00	13.875	....	....	....	1.75i	1.66hi	1.66hi	.32
Montreal	9.25	6.25	2.50p	4.90p	3.15p	2.75	2.07	2.07	.94
New York	10.00	13.75	2.03	....r	1.64	1.66	1.58h	1.58h	.26
Philadelphia	10.00	13.75	....	....	....	1.75	1.66	1.66	.32
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.94h	1.94h	.34
St. Louis	10.00	13.75	2.28s	2.89s	1.96s	1.91	1.66	1.66	.28
San Francisco	10.25	14.00	1.80	2.75n	1.35/2.35	1.71	2.40	2.40	.33
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16h	....	.35

‡ Delivered Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 2% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per *l* Per lb. *m* Per bbl. *n* May, 1941 price, no later quotation available 8% sales tax. *r* Not available, except on priority rating; then quoted *s* December price.

SKILLED AND COMMON WAGE RATES—PER HOUR

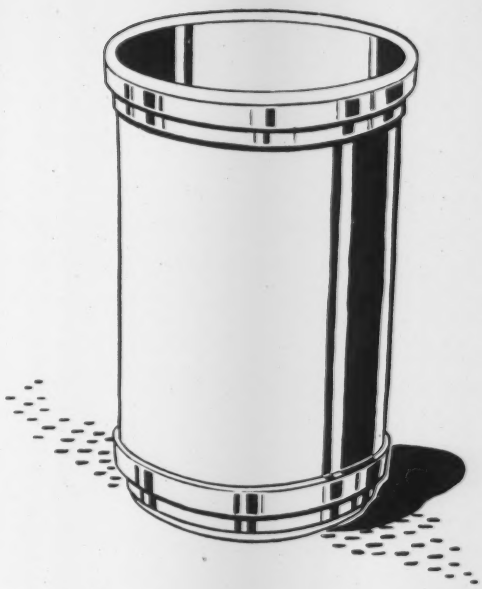
	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor—Building	Common Labor—Heavy Const.
Atlanta	$1.50	$1.25	$1.375	$1.25	$1.50	$0.40	$0.50
Baltimore	1.75	1.375	1.80	1.625/1.80	1.50	.70	.70
Birmingham	1.75	1.125/1.25	1.50	1.25/1.50	1.50	.65	.65
Boston	1.625	1.50	1.65	1.875	1.667	.80/1.00	.80/1.00
Chicago	1.75	1.70	1.76	1.75	1.825	1.10	1.10
Cincinnati	1.75	1.50	1.625	1.40/1.60	1.625	.85	.85
Cleveland	1.75	1.55	1.75	1.75	1.75	1.00	1.00
Dallas	1.625	1.25	1.50	1.75	1.625	.60	.75/1.25
Denver	1.65b	1.50b	1.625b	1.43b	1.51b	.80b	.80b
Detroit	1.675	1.50	1.75	1.625/1.75	1.675	.90	.90
Kansas City	1.65	1.50	1.625	1.625	1.65	.90	.90
Los Angeles	1.50	1.35	1.625	1.375	1.667	.875	.875
Minneapolis	1.50	1.375	1.50	1.40	1.50e	.925	.925
New Orleans	1.50	1.25	1.50	1.50	1.375	.65	.75
New York	2.00b	1.85b	2.00	2.00b	2.00b	1.031	.95
Philadelphia	1.90	1.50	1.90	2.00	2.00	.825	.825
Pittsburgh	1.90	1.75	1.75	1.8125	1.875	.90	.80
St. Louis	1.75	1.50	1.75	2.00	1.75	.95	.95
San Francisco	1.75	1.4375	1.75	1.50/1.75	1.75	.95	.95
Seattle	1.78	1.48	1.68	2.00	1.78	1.08	1.10
Montreal	.965	.855	.90	.80	.945	.505	.505



ENR Skilled Average; (Bricklayers, Carpenters, Ironworkers)
ENR Common Average; $0.858

b 7 hr. day. c 30 hr. wk.

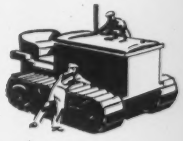
ı can buy a new tie 3 minutes...



but it may take weeks to renew a scored cylinder

e answer is eventive Maintenance w with Shell esel Lubricants

SHELL



When rings stick, allowing hot gases to blow-by the pistons, it's good-by cylinder liners and piston rings . . . parts you can't always get when you need them. Then, too, there's that matter of an idle piece of equipment while new parts are installed. Many of these time-wasting failures can be avoided by careful attention to lubrication.

In peacetime, Diesels were operated under more or less normal conditions. But today, engines are being worked harder and for longer, continuous periods of time. This means oil should be changed at more frequent intervals.

Yes, these more frequent changes do take time. But the few minutes they do take may save you days of delay later. Don't wait for a breakdown. Call in the Shell man now. Let him help you plan your Preventive Maintenance.

ARMY E NAVY

First oil refinery to win Army-Navy "E"— Shell's Wood River Refinery.

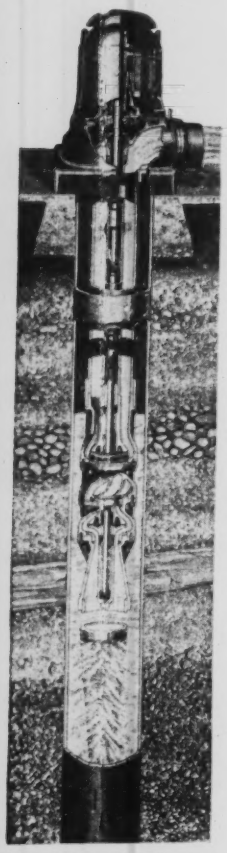
SHELL DIESEL LUBRICANTS
AND SHELL "DIESELINE"

Make Your Pump Last Longer

LET'S KEEP 'EM FLOWING

Your Peerless Pump is ruggedly built for years of hard service, regardless of usage. But it will run better, deliver your water supply more faithfully, over a longer period of time, if it is given the attention it deserves.

Do your part—make your pump last longer. Ready to serve you in case you need pump parts or service is the whole Peerless organization, manufacturer and dealers. These dealers know your pump,—know how to keep it flowing. Call on them for service,—that's one of the important parts Peerless dealers are playing to help you win the war.



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Also inquire about Peerless Gasoline and Fuel Oil Pumps for direct refueling and transfer.

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Factories: Los Angeles, San Jose, Fresno, Calif. and Canton, Ohio

★ WATER OR OIL LUBRICATION
Peerless
TURBINE PUMPS

(Continued from p. 112)

the Superintendent of Documents, Washington, for *Public Health Reports*, Vol. 58, No. 5, Jan. 29, 1943. Price 5c.

PROGRESS IN PROFESSIONAL DEVELOPMENT in the engineering fields is reported in the tenth annual report of the Engineers' Council for Professional Development (33 West 39th St., New York City, 25c.) This report contains the list of engineering schools in which courses have been accredited by E. C. P. D. as well as summaries of current activity of E. C. P. D. committees in such matters as student selection and guidance.

MECHANICS OF RENEGOTIATION is the subject of a reprint from the March, 1943, *Journal of Accountancy*, that is available from the American Institute of Accountants, 13 East 41st St., New York City. The author, Carmen G. Blough, is chief of the contract review branch, procurement policy division, War Production Board, and a member of price adjustment boards of the Army, Navy and Maritime Commission.

New Engineering Books

MECHANICAL VIBRATIONS—By R. K. Bernhard. 139 pp. Pitman Publishing Co., New York. $3.

MECHANICS OF MATERIALS—By S. G. George and E. W. Rettger. Second Edition. Revised by E. V. Howell. 491 pp. McGraw-Hill Book Co., Inc., New York & London. $3.75.

INTRODUCTION TO REINFORCED CONCRETE DESIGN—By Hale Sutherland and Raymond C. Reese. Second Edition. 559 pp. John Wiley & Sons, Inc., New York & London. $5.

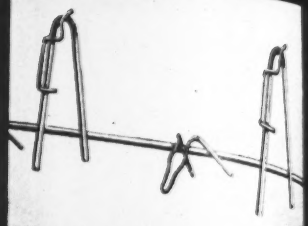
FIRE PUMPS AND HYDRAULICS—By J. E. Potts and T. H. Harriss. 158 pp. Chemical Publishing Co., Inc., Brooklyn, N. Y. $2.50.

PLANE AND SPHERICAL TRIGONOMETRY—With four-place tables and tables of haversines by William C. Brenke. 269 pp. The Dryden Press, New York. $1.90.

A MANUAL IN ENGINEERING DRAWING—By Herman C. Hesse. 110 pp. The Macmillan Co., New York. $1.50.

BUILDING ESTIMATORS' MANUAL—By T. H. Coe, Jr. 124 pp. Coe & Co., 75 Pearl St., Hartford, Conn. $6.50.

Eliminate TIE WIRES
Save Material, Time and Labor



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Combination Snap-In Slab Spacer and Hi-Chair

● These US 417 units permit "factory production" on the job. They greatly speed up placement of concrete reinforcement. They eliminate all tie wires. Can be used on any reinforced concrete construction . . . especially recommended for bridges, igloos, war plants, etc. . . . comply with Federal Specifications.

SPECIALTIES: Union Steel offers a wide variety of construction specialties. Write for catalog. See Sweet's, Sec. 3-52.

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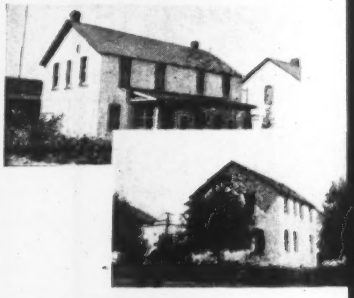
MODERNIZED HOUSIN FOR MINERS



These photos show three of nine old b buildings reconditioneed by the use "GUNITE," on the property of Dome Mi Ltd., South Porcupine, Ontario, Canada. buildings include a machine shop, po house, refinery, store and dwellings.

Our Bulletin 2200 shows many exam of the superiority of "GUNITE" for build both in reconditioning and new construc Send for your copy today.

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WE ARE ALSO "GUNITE" CONTRACTORS LET US BID ON YOUR WORK

ROEBLING "Blue Center" is in there with them!

Trained and equipped to work *and* fight, our U. S. Navy Construction Battalion—"Sea Bees"—are erecting needed bases and facilities in the South Pacific today as fast as the terrain can be reasonably cleared of Japs. As often as not, before turning to jobs like the generator installation above, these versatile recruits from America's construction industry lend a hand with the "terrain clearing" themselves . . .

Wherever these work-wise veterans are working—hacking an airport out of New Guinea jungle, installing a generator to furnish light and power for beach installations in the Solomons, building roads and barracks and bases the world around—they use wire rope they know they can depend on to work and fight right along with them. Rope that has the right qualifications—type, size, construction—for the job on hand.

That's why you'll find Roebling "Blue Center" Steel Wire Rope on the job today where you find tough going like this. For with the know-how gained in more than 100 years of wire-rope engineering, Roebling men build into "Blue Center" the extra value that helps it meet the most difficult conditions unflinchingly. As battle-wise and work-wise as the "Sea Bees" themselves, "Blue Center" Rope is giving a fighting account of itself in thousands of installations—on cranes and bull-dozers and shovels, on ships and hoists and drilling lines.

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ARE YOUR ROPES WORKING . . . OR FIGHTING TO WORK?

You can help your ropes work better, longer by relieving them of the necessity of *fighting* against worn sheaves, lack of proper lubrication, incorrect installation procedure . . . To help you do just that, Roebling has assembled a store of conservation data—summarized it on a handy 4 x 5 inch tag that you can put right onto your equipment. It's a simple, direct way of keeping your operating men constantly posted on the correct way of handling and using wire rope on the job. Copies of this tag are yours for the asking. Our nearest office will furnish you with as many as you need. Ask for Tag "A".

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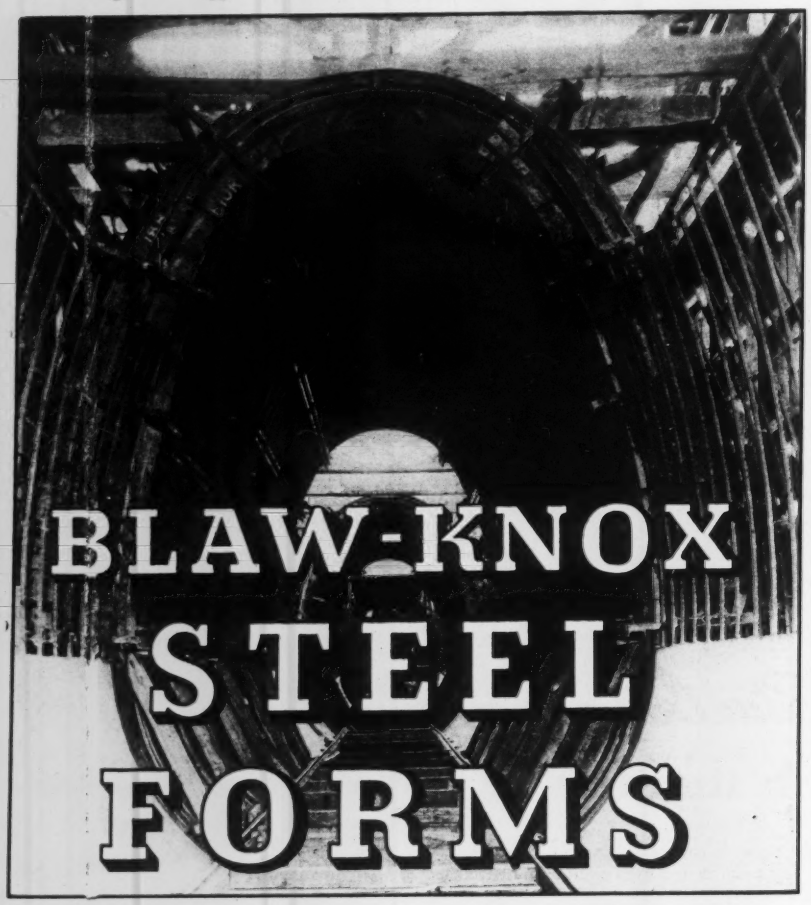
TRENTON, NEW JERSEY *Branches and Warehouses in Principal Cities*

Utilize Blaw-Knox experience in job planning . . . . . .



Blaw-Knox form engineers have the "know-how" to help you plan a concrete construction job so that the work will be done in quick time and at the lowest possible cost.

This is a service which Blaw-Knox has given without charge to engineers and contractors for more than 36 years, resulting in the economical building of thousands of concrete projects, both large and small, with the use of Blaw-Knox Steel Forms.

Current construction work of a sufficiently urgent nature can now be served, and long range planning for the proper handling of future jobs can be aided by experienced Blaw-Knox engineers.

BLAW-KNOX STEEL FORMS are used for the construction of
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NEWS OF THE WEEK

(Continued from p. 75)

N. Y. governor demands more oil by barge canal

New York State Governor Thomas Dewey, has asked the state legisla to provide for improvements in the S Barge Canal that will aid in the tra port of gasoline and fuel oil to gu against shortages next winter.

The improvements asked by the G ernor, with the approval of the Divi of Commerce, would consist of the stallation of a signal-control system a dredging of passing points in the w ern section of the Canal from N Tonawanda, just outside Buffalo, to Lo port, where a bottleneck now exists barges bringing oil in from the Gr Lakes lanes and terminals to the ea ern seaboard and intermediate poi The Governor estimates that the und taking will cost $152,000 for which asked an appropriation in the supp mental budget to be adopted by legislature.

• • •

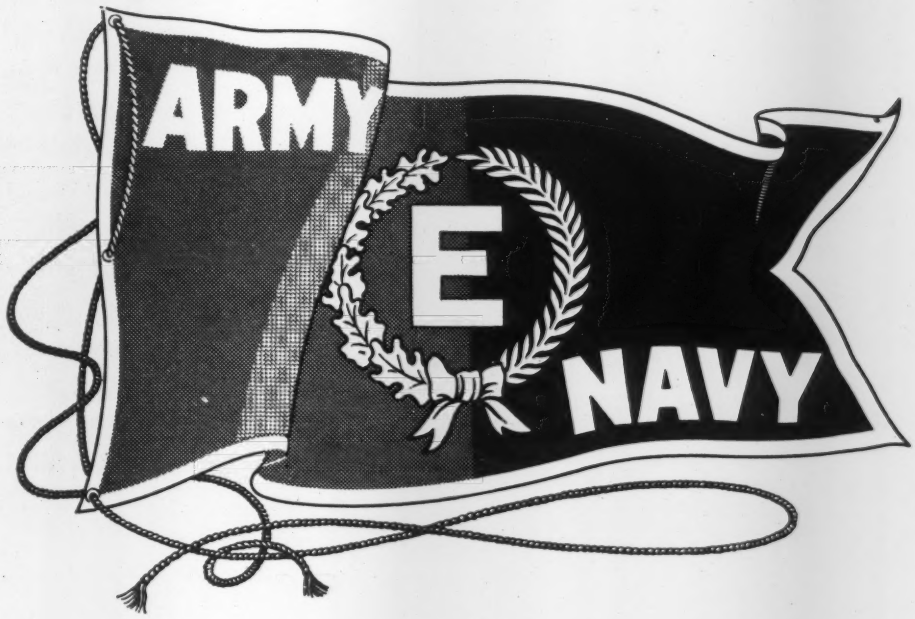
Record road construction in Maryland

The Maryland State Roads Commi sion reports that it has a record-break mileage of new roads under construc at the present time largely as a re of access highways to serve strat war production areas and new and panding military establishments. Becau of the war urgency of the projects, t War Production Board is granting t highest priorities possible so that co tractors may secure highly critical mat rials. Either the War Department or t Navy Department, or in many cases bo of them certify as to the war urgency the access highways now under constru tion, which call for an outlay of mo than $15,000,000.

• • •

Locks at Cascades to become war scrap

Call for bids recently published War Materials, Inc. of San Francisc revealed the fact that the great ir gates of the locks at the Cascades the Columbia River above Bonnevil Dam in Oregon, are to be removed an used in the manufacture of vital w materials. Local engineers say that mu of the work will be under water an divers will be employed. Since the co pletion of the ship lock at Bonnevil Dam, the locks at the Cascades are n longer used or of any practical val



LaPLANT-CHOATE wins the coveted Army-Navy "E" Production Award

O the men and women of the LaPlant-Choate organization whose hands, minds, and energy have n this high honor, we say: 'Well Done'. Your high devo- n to duty in your country's time of peril has won you deep and lasting admiration of your fellowmen.

e Army-Navy 'E' is never lightly bestowed . . . it is arded only to those with the courage and vision to face gantic tasks and then to smash vigorously forward . . . those who produce 'too much, too soon' instead of 'too le, too late'.

ere is only one language Hitler and his kind understand . . and you speak it well as you man your machines, ashing production record after production record.

e Army-Navy 'E' stands for efficiency. It is a symbol an honor won and a new responsibility, too; but your past record shows you have what it takes to keep your 'E' pennant floating proudly over your plant until Victory is won!"

★ ★ ★

As we accept our "E" award, we want to proclaim publicly our appreciation of the valiant efforts of our materials suppliers without whose complete cooperation our job could not have been done.

And to our dealer-distributor organization in the field which has rendered, and will continue to render, yeoman service in keeping LaPlant-Choate equipment on the production front 24 hours a day, we express our deepest appreciation. Their efforts have, in large measure, been responsible for keeping LaPlant-Choate equipment "tops" on the job at all times!

LaPLANT-CHOATE

Factory & Home Office
Cedar Rapids, Iowa

Manufacturing Co. INC.

Pacific Coast Office
San Leandro, Cal.

ARTH MOVING - LAND CLEARING - SNOW REMOVAL EQUIPMENT

SAIGON, INDO-CHINA

Half Way Around the World

Looking south across the China Sea toward Singapore stands the city of Saigon, Indo-China. There also, half way around the world, you will find Layne Wells and Pumps producing millions of gallons of water daily.

Layne Wells and Pumps are in operation in all parts of the world. Their skillful design, sturdy construction and amazingly long life features are known to engineers everywhere. Facing a world of the keenest competition, Layne Wells and Pumps have long been rated as the finest that skill and experience can build.

Primarily designed and built for peace-time work, Layne Wells and Pumps, under rigorous war-time overload conditions, are today making a magnificent record. Failures are almost unknown—a splendid tribute to the company's slogan of "Better Built for Better Service."

Production is now nearly 100 percent for the war effort, but every effort is being made to keep private and municipal installations in operation. For literature, address,

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WORLD'S LARGEST WATER DEVELOPERS

Pioneer railroad route becomes highway

Work in constructing the first transcontinental railroad more than 70 years ago, is going to benefit Box Elder County, Utah. The old Southern Pacific line between Corinne and Lucin, torn up last fall to provide rails for a naval supply depot switchyard, will become a highway 115 miles long. The Grazing Service is building the road, which will provide a well-drained, all-weather stretch of highway for use of fire-fighting crews, range improvement workmen and administrative officers of the district. The road also will be of importance to livestock operators who are allotted use of vast Federal ranges paralleling the line.

District Grazier Milton A. Oman, in charge of highway construction, reports 60 miles of ties on the east end of the line are pried out, and that all bridges in that section left in place by the Southern Pacific have been planked, making them suitable for automobile travel. Just as soon as the ground is free from frost, the remaining ties will be removed, bridge work completed, and the grade smoothed down and widened. Thus the once-famous railroad route will become a scenic, useful highway. It was at Promontory station on this route that the golden spike was driven to celebrate the completion of the first transcontinental railroad by the Union Pacific and Central Pacific railroads on May 10, 1869.

War, weather and wear triple threat to highways

Discussing road conditions in Pennsylvania, John U. Shroyer, Secretary of Highways for that state, says that war, weather and wear are the three things which are creating problems for his department at the present time. He states that 1,453 former highway employees are in the armed forces. The construction and repair of scores of bridges in the state have been delayed by inability to obtain priorities on necessary steel. Last autumn was extremely wet. Consequently, when winter came much ice was formed in the ground under the roads. The road surface was raised. Then as the ice melted, the ground beneath contracted in many places, so that any heavy load caused the pavement to break. This is serious because Pennsylvania roads are bearing a large volume of traffic, due largely to war production, both that originating in Pennsylvania and also that passing through from other states. Notwithstanding all these difficulties, Mr. Shroyer says his department is sparing no effort to get the essential materials and to make repairs as quickly as possible so that this important traffic will no be delayed.

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see full page ad page 129

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You'll find Blue Brutes are built to keep the job powered with air through mud and high water. Many Worthington 105 and 160 cubic foot compressors, Diesel-driven, dressed in uniforms of olive drab‡, helped the British 8th Army keep Rommel on the run, even before the Yanks hit Casablanca.

Name your conditions! Blasting an Alcan highway through hardest rock of the frozen north or building fortifications under the scorching desert sun — Blue Brutes will power your air tools with steady, easy breathing!

Their Feather* Valves, strongest and simplest, keep their throats clear for maximum air power, so you save the precious time you're bound to lose when lesser breeds wheeze, cough, and whine for the tool-shed.

Take your pick. Portable or semi-portable — gasolene, diesel or electric driven, *all save air*, deliver more air for every power dollar you spend.

Use them with Worthington Rock Drills and Air Tools which *use less air* and give you surprising ease of handling for their size and power. Then you'll have an air-power team that spells "more WORTH from air with Worthington!"

*Reg. U. S. Pat. Off.
‡Blue Brute Compressors and Air Tools are painted olive drab for the Army and battleship gray for the Navy.

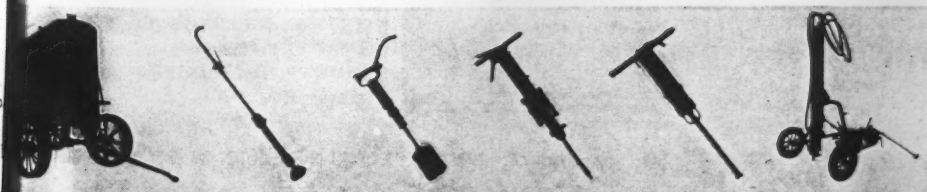
Behind the Fighting Fronts with

BLUE BRUTES

With the "Sea-Bees" and construction companies building bases in the Atlantic and Pacific, "Blue Brutes" in battleship gray‡ are working around the clock. Air power for thousands of industrial operations, as well as construction projects, is provided by Blue Brutes, at work today in hundreds of Army camps, Navy yards, air bases and ordnance plants throughout the country. Your nearest distributor is listed on page 128.

Get more WORTH from air with WORTHINGTON

BUY BLUE BRUTES



pressors from 60 to 500 cu. ft. capacity in mount- to suit all jobs. Rock Drills and Air Tools that have always set the pace for easy operation — available in a wide range of weights and sizes.

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Worthington Pump and Machinery Corporation, Harrison, N. J. Holyoke Compressor and Air Tool Department, Holyoke, Massachusetts

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THE RAILROADS are among the earliest and most consistent users of Wolmanized Lumber*. Bridge timbers, stringers and ties, wharf and platform decking—life is tough on jobs like these. But this wood is "alloyed for endurance," armed against decay and termite attack, so it can take it.

RESILIENCE, the cushioning effect between trackbed and supporting steel, is retained where Wolmanized Lumber is used in structures like that illustrated above. This wood also offers light weight, ease of handling and erection, high strength. It is clean, odorless, paintable. There is no added fire hazard, and the wood is not corroded by brine drippings from refrigerator cars. Nor does it corrode its metal fittings.

SERVICE RECORDS covering millions of feet of Wolmanized Lumber, at work for the railroads and elsewhere in industry, provide evidence of its durability. Lasting ability is given ordinary wood by vacuum-pressure impregnation with Wolman Salts* preservative. "Fibre fixation" prevents leaching out.

WOLMANIZED LUMBER is being employed for wartime structures all over the world, speeding erection, assuring long life. It will do the same for your peacetime construction. American Lumber & Treating Company, 1649 McCormick Building, Chicago, Ill.

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"Alloyed" FOR ENDURANCE

WOLMANIZED LUMBER

Elections and Activities

J. S. Dodds, professor of civil neering at Iowa State College, Ame was elected president of the Iowa neering Society at its 55th annual vention in Des Moines. L. C. Cra of Iowa City was elected vice-pres and E. F. Behrens of Des Moines, urer.

W. H. Pitts and A. M. Herring elected recently to succeed R. E. R son and W. C. Sloan as directors City, Water & Light Co., Jonesboro,

W. E. Callahan Construction of Dallas, Tex., and Los Angeles, has elected new officers as follows E. Callahan, former president, is chairman of the board; Paul Gra merly vice-president, is now presi and W. K. McLlyar, formerly tary-treasurer, is now vice-president new vice-presidents are J. A. Wo and Vincent M. Flynn.

William Armstrong, of Racine a new member of the Wisconsin Highway Commission, has been pointed chairman of the commissio Governor Goodland to succeed Wil O'Brien of Kenosha, Wis., who tinues as a member of the commis Michael Mack, Shiocton, Wis., is third member.

William F. Cavanough, Milwa county highway commissioner, has elected chairman of the Milwa county safety commission for the n consecutive time.

V. E. Scott, assistant director secretary to the Arkansas State Hig Commission, is the newly elected p dent of the Little Rock Engineers C Other officers are Vice-President C. Greer and secretary-treasurer Joh Hall.

J. A. Fowler, executive director the Memphis (Tenn.) Housing Aut ity, has been elected chairman of southeastern regional conference of National Association of Housing Offic

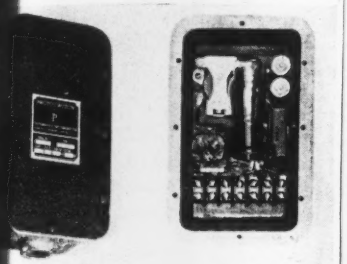
Myron L. Jones, St. Paul, Minn. been elected president of the Minn Surveyors and Engineers Society 1943. H. G. Nicholson, of Minneap is vice-president, and Walter Schu of St. Paul, secretary-treasurer.

At the Annual Meeting of the tario Road Builders Association, F Cross of Toronto was elected presid and W. L. Dobbin, of Toronto, secret treasurer.

NEW AIDS THE CONSTRUCTOR

Undersea Lamp

ersea lamps, which in the past have in many spectacular salvage and operations, now are being put to ant wartime uses. They are fur- the needed illumination for war- epair work and salvage operations ps, docks and harbor installations. unusually favorable conditions, ht rays of this lamp will penetrate as 50 or even 75 ft. Where the is roiled, however, visibility might more than 2 ft. In New York , for example, where the water is churned continually by heavy ship- the penetration of light would be imited. Nevertheless, the glow that ly discloses objects close by, and comfort of having a sub-surface lantern" greatly aid the diver in angerous and important work.— *nghouse Electric & Mfg. Co., East urgh, Pa.*

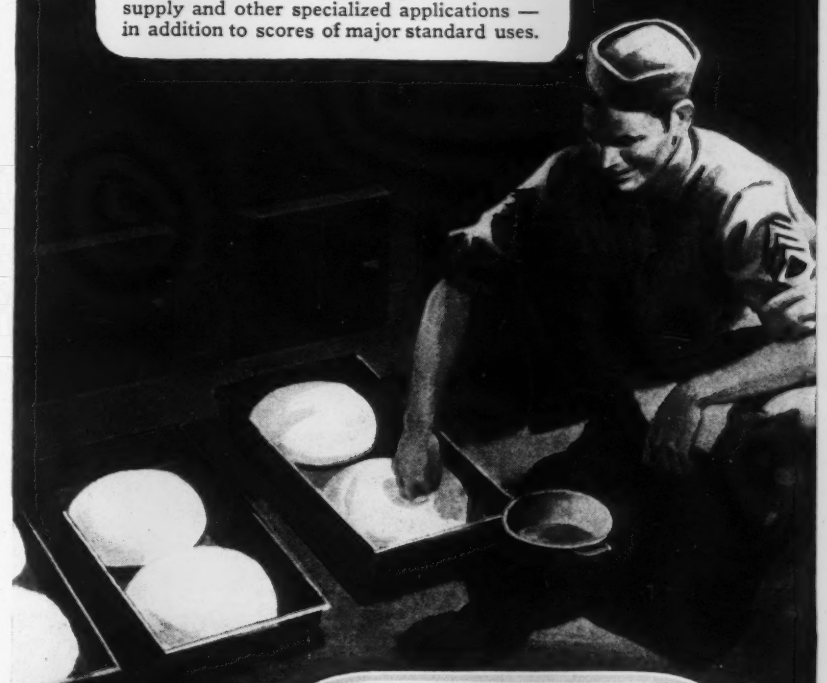


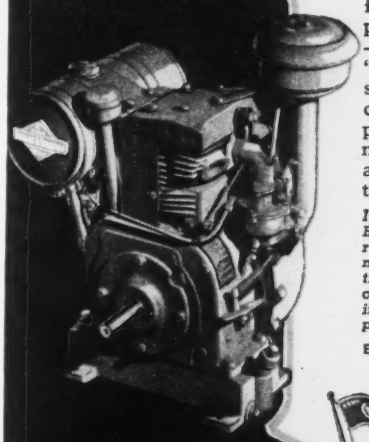
Electronic Level Controls

new series of electronic level con- designed particularly for hazardous ion mounting is announced. The pment is supplied for use with con- ive liquids of an explosive nature. models are available for high and evel control. Each is furnished as a plete unit in a vapor-proof, cast-iron ing for direct tank installation. High- control is accomplished when liquid and contacts the probe tip; low- control, when liquid drops below probe tip. Both models incorporate fety feature providing for operation e relay in case of current or tube ure. Of particular interest is the use ype P15NHX to control the level of conductive liquid, such as water or s, in tanks of gasoline, oil, or similar conductive materials. — *Photoswitch rporated, 21 Chestnut St., Cam- ge, Mass.*

AND WE HAD "Real Bread"

"Our boys," in distant lands, get *real bread* — made the American way in "portable" kitchens. Just another way Briggs & Stratton gasoline motors are serving — furnishing power for bread mixers, refrigerators, water supply and other specialized applications — in addition to scores of major standard uses.





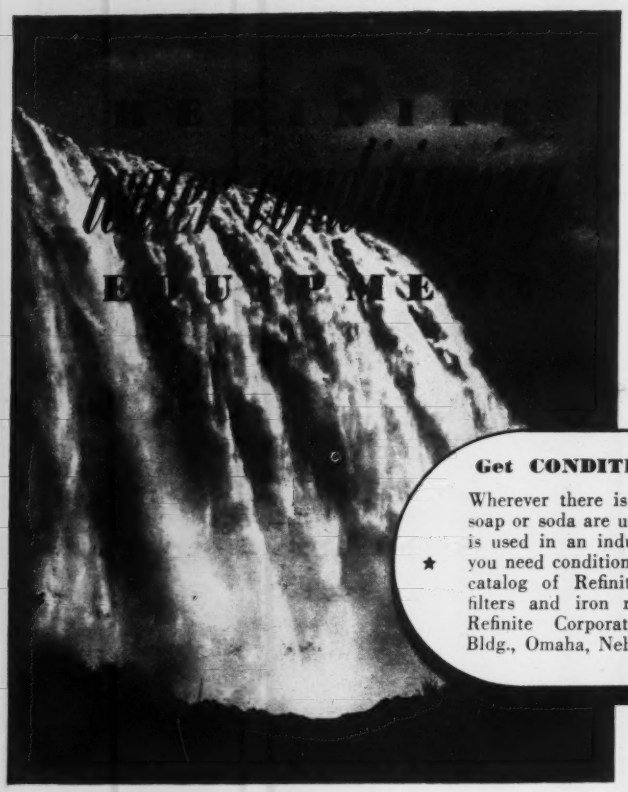
We're in full production on Briggs & Stratton 4-cycle, air-cooled gasoline motors — for the war program and approved "essential" civilian uses — but there are not enough "new" motors available to supply the demand. As a special service, we are trying to place "used" Briggs & Stratton motors that may not now be in active service, in the hands of those who need them so badly.

If you have, or know of any Briggs & Stratton motors not now in regular use—please write us, stating model numbers and general condition. It makes no difference how old they are. We will assist in making contacts between owners and prospective purchasers.

BRIGGS & STRATTON CORP.
MILWAUKEE, WIS., U. S. A.

4 CYCLE
BRIGGS & STRATTON
GASOLINE MOTORS

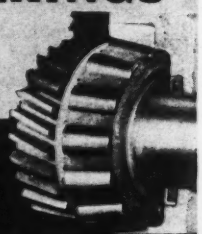
FOR VICTORY
Invest in
WAR BONDS



Get CONDITIONED Water

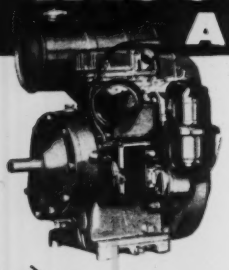
Wherever there is a boiler, wherever soap or soda are used, wherever water is used in an industrial process. . . . you need conditioned water. Write for catalog of Refinite water softeners, filters and iron removal units. The Refinite Corporation, 102 Refinite Bldg., Omaha, Nebraska.

TIMKEN ROLLER BEARINGS in a SINGLE CYLINDER ENGINE?



Certainly — if it's a

WISCONSIN AIR-COOLED ENGINE



No Wisconsin Engine, so far as we know, has ever had a case of "Bearing Failure." Basically, this is an end result of using Timken Roller Bearings at both ends of the crankshaft. Normally, small engines are not provided with this safeguard . . . but every Wisconsin Engine, whether single cylinder or 4 Cyl.; 1 hp. or 35 hp., has this heavy-duty service protection.

This is a typical example of Wisconsin Air-Cooled Heavy-Duty Engine design and construction . . . geared to maximum utilization of power-operated equipment.

MOST POWER Per POUND

WISCONSIN MOTOR Corporation

MILWAUKEE, WISCONSIN, U. S. A.

World's Largest Builders of Heavy-Duty Air-Cooled Engines

Materials Handling Equipm

A new model cent[er] control tele[scopic] lift tilting fork truck measures on[ly] in. from 30 in. fork tip to stern, a [com]pact, flexible, versatile materials han[dling] tool that speedily navigates narrow [aisles] around sharp corners, and in close [quar]ters, carrying full capacity loads. [The] equipment has single fork height [of] 71½ in. and additional telescopic [lift] reaches to 129 in. It has four speeds [for] ward and reverse, all controls are easily accessible positions, and the [lift] ing and tilting controls are fitted [with] mechanical limit safety stops. The [oper]ator is placed in the center of the [truck] chassis frame, in a protected position with perfect visibility in all directions.—*The Yale & Towne Mfg. Co., Philadelphia, Pa.*

Wire Nuts

Electrical manufacturers, contractors and plant electricians who are affected by recent War Production Board orders reducing the amount of tin and solder and limiting the use of solder are [trying] to have an immediate solution to the problem in Ideal screw-on type "Wire-Nuts." No rubber, tin or lead are used in these "Wire-Nuts" and their [insu]lating ability is not affected by the war situation. The nuts consist of a cone-shaped spiral spring insert, imbedded in molded insulation. The joint is made by stripping the wires about ½ in. and then screwing the wire-nut on the stripped ends, much the same as screwing a nut on a bolt. The spring inserts presses clean threads into the wires, making a perfect joint electrically and strong mechanically.—*Ideal Commutator Dresser Co., Sycamore, Ill.*

Floor Cleaning Compound

A new floor cleaning compound is said by its manufacturer to eliminate the danger of fire usually inherent in materials sold for this purpose. The product is said not to burn even when the flame of a blow-torch is played directly upon it, nor as the result of spontaneous combustion. Grease and oil-caked dirt are said to be removed; safety stripes and other floor markings made plainer and, in general, plant housekeeping is greatly improved.—*Lacey-Webber Co., Kalamazoo, Mich.*

Explosion-proof Motors

A new line of vertical hollow shaft explosion-proof motors are now offered for operation in hazardous gas locations. These motors are designed primarily for pumps handling large quantities of volatile materials. Both horizontal and vertical types can be furnished.—*Fairbanks, Morse & Co., Chicago, Ill.*

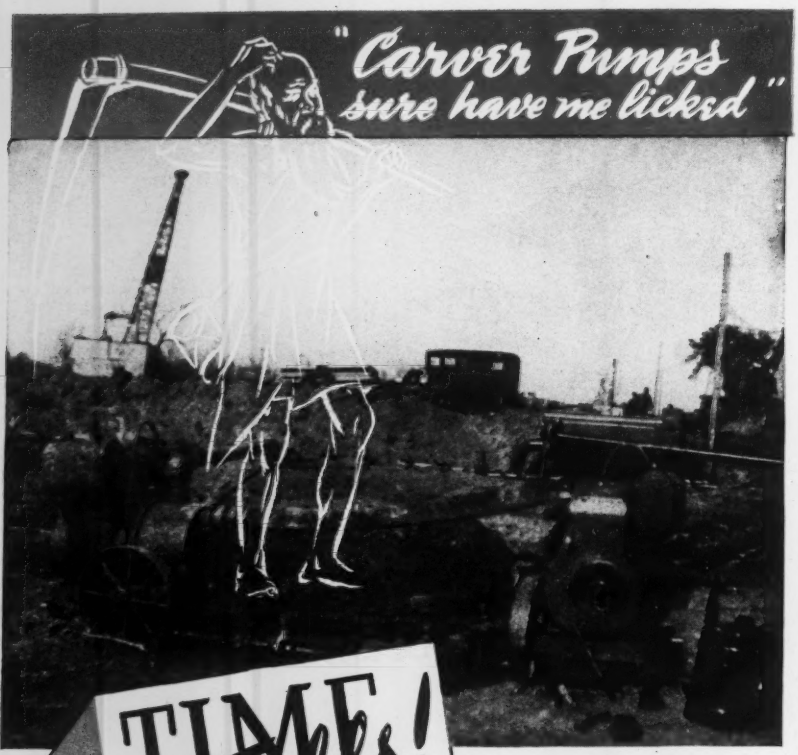
PE LINE CONSTRUCTION on the "Big-Inch" War Emergency Pipe Line is one the current activities of the W. A. Bechtel Co.

W. A. BECHTEL CO

Constructors

SAN FRANCISCO

ject illustrated: A joint venture,
chtel-Dempsey



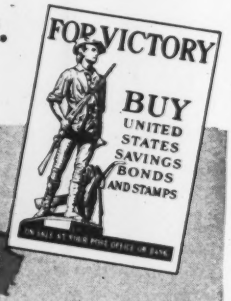
Two Model 3815 Carver pumps in tandem on the well-point suction line at a Minnesota sewage project — Oakes Bros. Construction Company, contractors.

FROM drafting board to final tests, Carver pumps are in the hands of men who *know* what pumps must do *on the job.* Every design feature, every bit of material selected, every step of manufacture is aimed toward building the kind of pump that delivers the *most* out of every hour on the job —and that *stays* on the job for hundreds of *extra* hours.

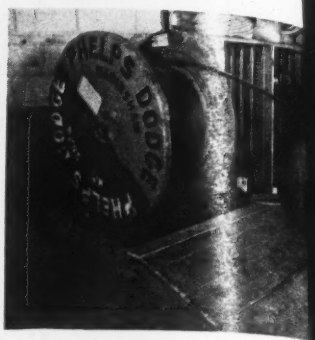
Carver's simplified design with fewer wearing parts, Carver's time-defying Lifetime Seal, Carver's longer-lasting impeller and removable liner are but a few of the features that make these outstanding centrifugals winners against old Father Time.

Get the facts . . . your Carver distributor will gladly furnish full information on the *complete* Carver line, or write directly to:

THE CARVER PUMP CO.
Muscatine, Iowa



CARVER CENTRIFUGAL Certified PUMPS



Cable Reel Dollies

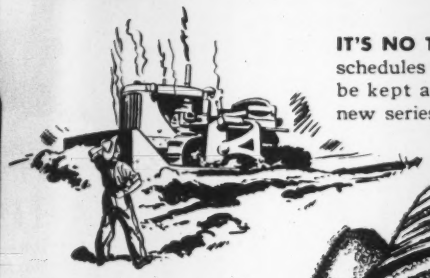
Here is a dolly that does awa tirely with blocks and jacks. You s roll the coil onto the dolly and to pay out. The base of this junior is made up of a highgrade of kil maple, firmly bolted. The two 6-i steel rollers are 36 in. long and o with ball bearings on a 1-in. dia. When the coil is in place you simpl gage a pin in the front roller to it rigid. The pin is attached by a to the side member of the base. is a larger dolly by the same pany. This is of the same constru only with 60 in. long rollers.—*Me Co., Grand Rapids, Mich.*

Goggle Cleaner

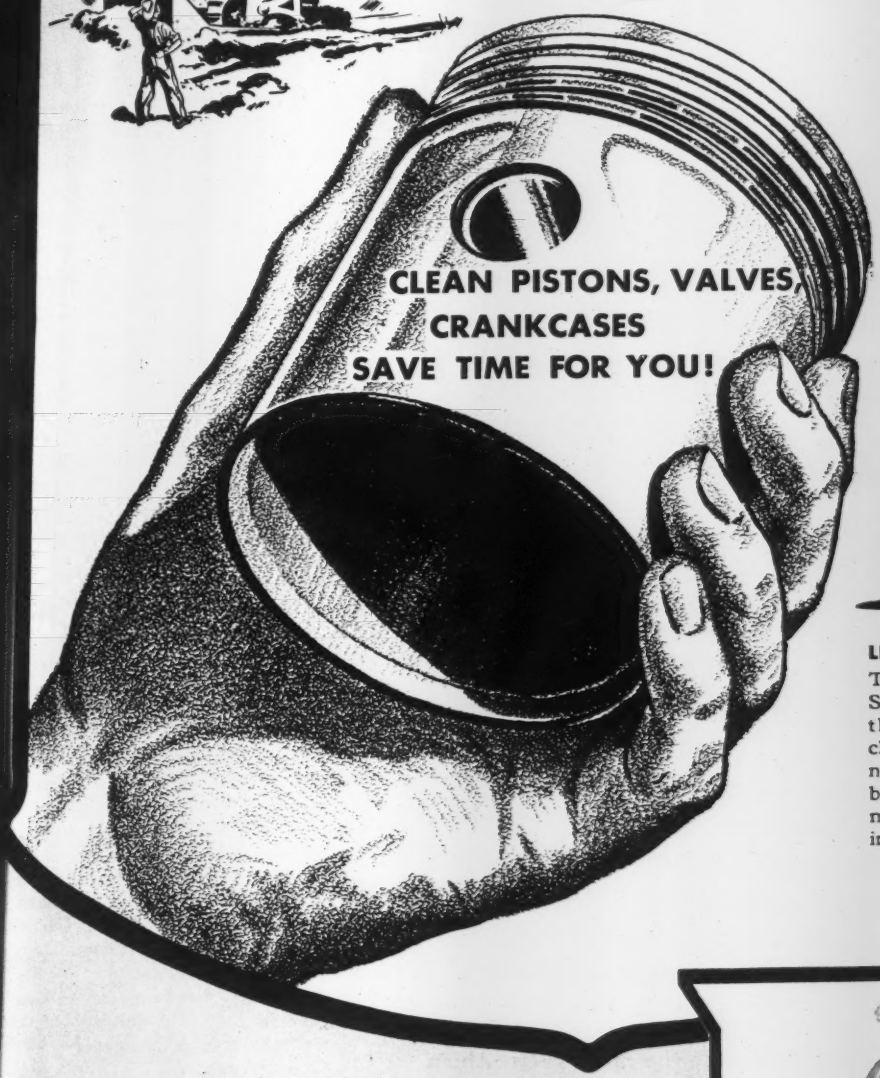
A new goggle cleaning station signed for convenient wall mounting sists of a compact case equipped wi efficient lens cleaning and anti-fog agent and optical wiping tissues. operation is simple. A tap on th verted vial sprays the material on goggle or spectacle lens. Cleaning sues are pulled from the opening in top of the station, and may be disca in a receptacle in the lower part of case. The front panel of the station s up, making easily accessible a com ment for an additional supply of t and the cleansing material.—*Mine S Appliances Co., Pittsburgh, Pa.*

An Efficient Spreader

This new spreader is designed to erate independently of the truck e for motive power. It is claimed th does away with the need for raking brooming—no patching, no cleaning edges, no filling in of low spots. said to spread with almost perfect formity and accuracy everything fro fine sprinkle of sand to a 1½-in. l of stone, regardless of truck speed. is made possible by a transmis driven, spirally-fluted feed roll. It erates forward or reverse equally The feed roll is driven by rever transmission.—*Buckeye Traction Di Co., Findlay, Ohio.*



IT'S NO TIME FOR ENGINE TROUBLE! With war-rushed schedules the rule, breakdowns and delays on the job must be kept at a minimum. Read below how a remarkable new series of Socony-Vacuum oils can help you do this.



LESS "DOWN TIME"... The new Delvac "900 Series" oils help reduce the number of engine cleanings and overhauls needed . . . enable valuable equipment to spend more time working, less in the shop! Read below.

A NEW GROUP OF SOCONY-VACUUM OILS

DELVAC "900 SERIES" keeps vital equipment on the job!

These new oils — recommended for *all* high-speed Diesel engines and gasoline engines in heavy service—contain detergents which give them remarkable properties.

They resist to an extreme degree the formation of "varnish," "lacquer," gum and sludge. They hold the products of combustion in suspension, so they do not settle out and form deposits. They assure maximum protection, as they are non-corrosive to hard-alloy bearings!

In short, you get far cleaner, safer engines than is possible with older-type oils!

SOCONY-VACUUM OIL CO., INC. and Affiliates: Magnolia Petroleum Co., General Petroleum Corporation of Calif.

Mobilgas

SOCONY-VACUUM

SOCONY-VACUUM FUELS, LUBRICANTS AND ENGINEERING SERVICE

YOUR CONSTRUCTION OF TOMORROW—

WARTIME USES in hundreds of essential structures—including hangars, war plants, armories, and warehouses—are proving that wood treated with Du Pont "CZC" is more than a mere "substitute" material. On its own merits, it is now recognized as a distinctive structural material—with a wide range of applications for both emergency and postwar construction.

Today the wartime advantages of "CZC" treated wood are all-important—to take the place of structural metal and as a means of speeding up critical construction. Highly resistant to decay and termites, lumber so treated also has definite and valuable fire resistance.

"CZC" leaves lumber odorless, paintable and clean to handle—retaining all of the fabrication advantages of untreated wood. Low in first cost, "CZC" treated wood also frequently makes possible savings in transportation and fabrication time.

Whether your problem is emergency wartime construction or planning for postwar, it will pay you to learn more about this du Pont wood preservative. Write for "Facts About Lumber Treated With Du Pont 'CZC'."

E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Department, Wilmington, Delaware.

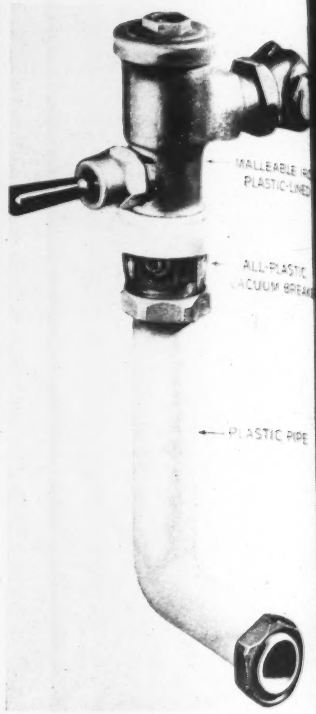
DU PONT
REG. U. S. PAT. OFF.

CZC

CHROMATED ZINC CHLORIDE

WOOD PRESERVATIVE

BETTER THINGS for BETTER LIVING . . . THROUGH CHEMISTRY



New Flush Valve

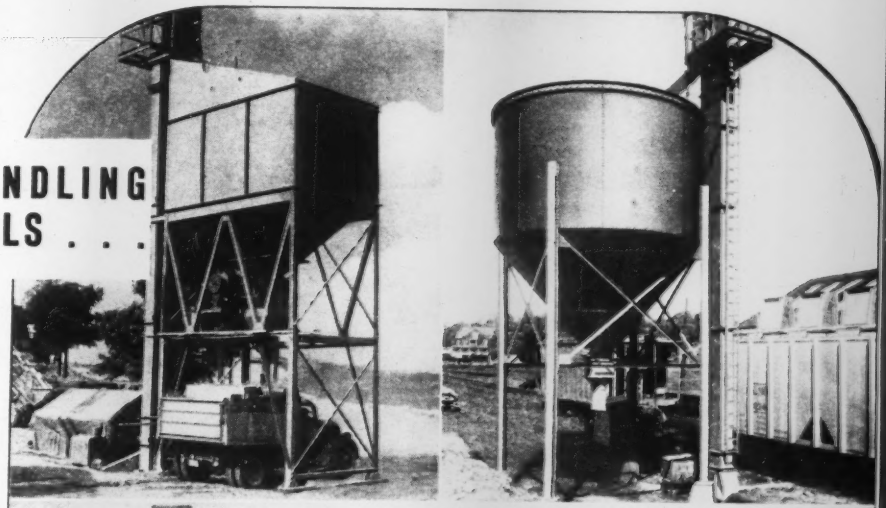
In cooperation with the War Pro tion Board's efforts to conserve cri copper, the manufacturers have re signed one of their toilet flush va so that its net copper content has b reduced from approximately 6 lb. to than 4 ounces per valve. This savi based on the company's present pro tion, will amount to more than 4,400 lbs. Various plastics and malleable has been substituted for the more cal brass used in the component p of the peacetime product. The new f valve, called the "Victory" type, been thoroughly tested. It has w stood accelerated-time tests equal to years normal service, without the n for repair or adjustment.—*Sloan V Co., Chicago, Ill.*

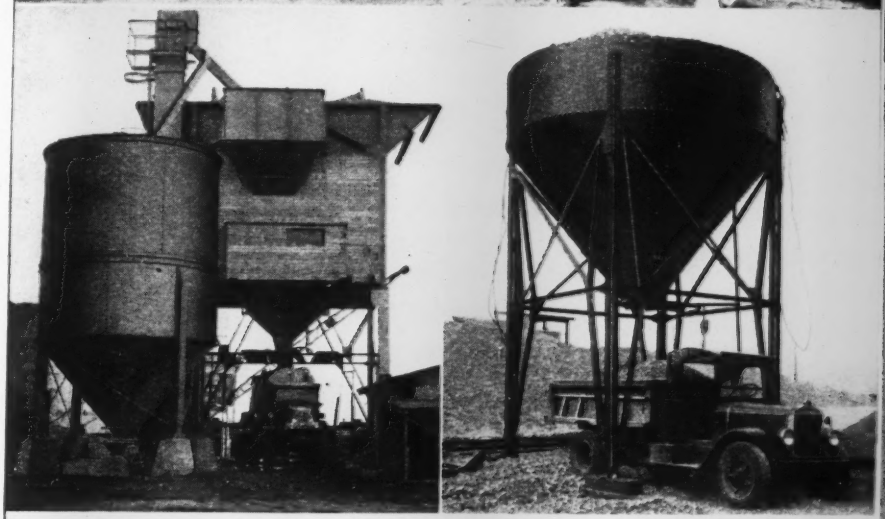
Fume Exhauster

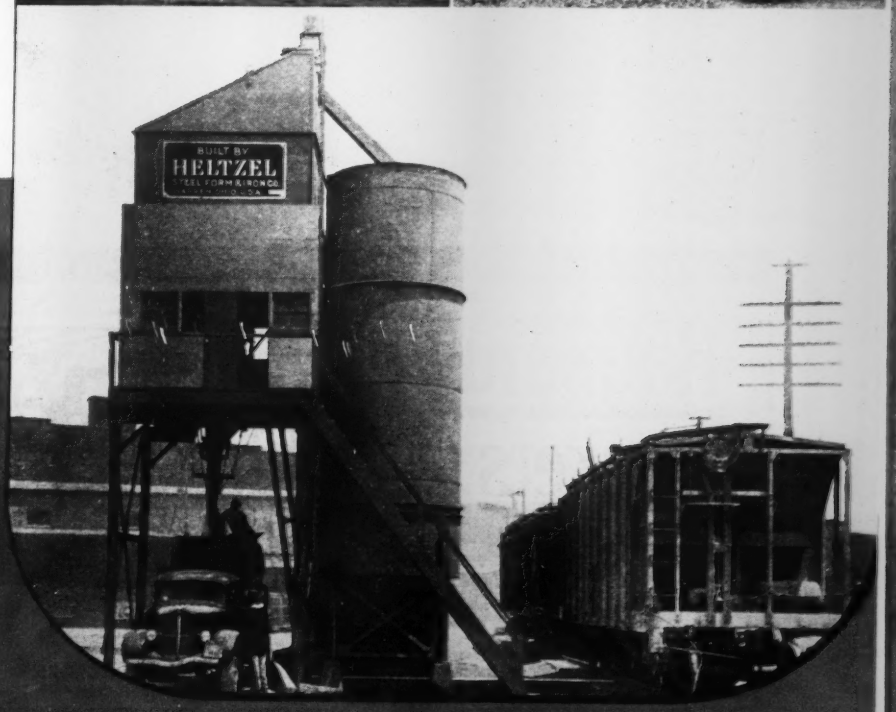
An important feature of this exha unit is that fumes, gases, dust, fil and grinding compounds cannot come contact with the motor. The newly veloped centrifugal type blower whee made of ⅛-in. thickness of steel. Th hp. ball bearing motor is tested to overload capacity so as to meet all rough usages to which a blower of type is subjected. The framework welded into a strong heavy unit w handles for carrying. The adapters interchangeable and can be used for s tion or blowing as desired.—*Chel Fan & Blower Co., Inc., 1206 Grove Irvington, N. J.*

Heltzel

S FOR STORING, HANDLING BATCHING MATERIALS . . .







been placed under government ations in order to help win the Our entire production has been arked for vital war effort con- tion.

ur operations are vital to our Vic- Program we are in a particularly able position to serve you . . . to speed up your material handling ations.

plete information is available on Loading Bins and Circular Stor- Bins from 35 to 300 tons for sand ravel . . . Portable Aggregate hing Bins from 35 to 100 tons ca- y for batch truck or truck mixer ging . . . Portable and Semi-Port- Bulk Cement Batching Bins from o 750 bbls. capacity . . . Perma- Aggregate or Combination Ag- ate and Cement Batching Plants 100 to 400 tons capacity with hers up to 5 cubic yards . . . Ce- Tanks for storing, batching or re- ling systems from 300 to 1500 capacity.

. . . INVESTIGATE !

ZEL SUPERIOR CRETE CONSTRUC- ION EQUIPMENT

- TARY HIGHWAY FORMS
- ORT FORMS
- 3, CURB AND GUTTER OR WALK FORMS
- TABLE AGGREGATE BATCH- BINS — 30 TO 100 TONS ACITY
- TABLE AND SEMI-PORTABLE CEMENT BATCHING BINS 100 TO 750 BBLS. CAP.
- TRAL MIXING PLANTS
- ENT TANKS TO 1500 BBLS.
- MIE CHUTING
- CRETE FLOOR HOPPERS
- CRETE BUCKETS

HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO · U. S. A.

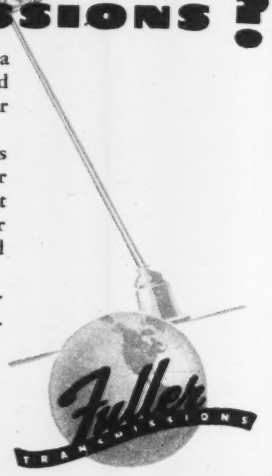
A "Blindfold TEST" FOR TRANSMISSIONS?

That's right—you can predict the service history of a transmission simply by *listening*. Noise means wear, and wear means a shorter life, more cost and lost time for servicing.

Fuller transmissions are recognized by truck owners and operators as being *quiet*. That's why drivers prefer them. That same quiet operation means the gears aren't "fighting" and wearing faster than they should. Fuller gears are precisely manufactured and accurately matched to deliver superlative service.

Many nationally recognized trucks have Fuller transmissions as standard. You can identify them by listening.

If you're now driving or maintaining one or more Fuller-equipped trucks, you'll want a copy of the new Mechanic's and Driver's Handbook. Write our Service Department for your free copy.



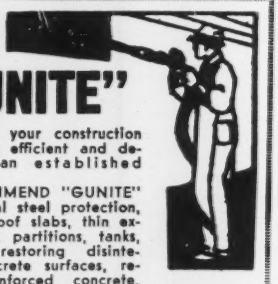
FULLER MANUFACTURING COMPANY . . . . . KALAMAZOO, MICHIGAN

Hayward Buckets

Use this Class "E" Clam Shell Bucket for handling crushed stone, gravel, sand and other bulk materials.

THE HAYWARD CO., 48-50 Church St., N. Y.

"GUNITE"



can reduce your construction costs. It is efficient and dependable, an established product.

WE RECOMMEND "GUNITE" for structural steel protection, floor and roof slabs, thin exterior walls, partitions, tanks, reservoirs, restoring disintegrated concrete surfaces, repairing reinforced concrete, etc. Let us suggest how "Gunite" can best solve your problems.

PRESSURE CONCRETE CO.
"GUNITE" CONTRACTORS
6 Avenue B Newark, N. J.

MANUFACTURERS' ACTIVITIES

THE GULF OIL CORP. has announced inauguration of fellowships in the fi of physics, chemistry, geology, engin ing, and business administration eleven of the country's foremost coll and universities.

Application for the fellowships is to graduates of recognized colleges universities and to men or women through established training and ach ment, are able to demonstrate their paredness for advanced training.

G. GARFIELD HOOD, general manager Ontario Steel Products Ltd., died Oshawa, Ont., March 8.

CATERPILLAR TRACTOR CO., Peoria, has been awarded the Army-Navy symbol for outstanding achievement the production of war material.

THE RECENT DEATH of J. W. Gardner the age of 79 calls attention to the f that for 60 years he was connected w one company, the Gardner-Denver C Quincy, Ill. Under Mr. Gardner's di tion the company grew from a sm concern employing 40 men to the pres company with its payroll of more th 2,000 employees.

COMMENDED for an outstanding achie ment in the war effort, approximat 250 employees of the Glamorgan Pip Foundry Co. of Lynchburg, Va., watch the Army-Navy "E" production fl raised in an impressive ceremony at t plant on March 9. More than forty hi ranking government officials, Army a Navy officers, and other dignitaries w present.

TO GIVE EACH INDIVIDUAL worker a dire personal report on how his job help various branches of the fighting servi to wage war, Towmotor Corp., Cle land manufacturers of industrial l trucks, is mailing a series of educatio folders to all employees. Reaching th worker at his home, the reports are a sured a more careful, thoughtful readi than is generally accorded bulletin boa or pass-out material.

APPOINTMENT of Willard Equipmen Ltd., 860 Beach Ave., Vancouver, B. C as exclusive distributors for British C lumbia for the shovel and crane divisi of the Lima Locomotive Works, Inc., Lima, Ohio, has been announced.

Ability to travel fast over any kind of terrain is the first qualification for an airport fire truck. Minutes may save precious lives and planes. Neither mud, nor sand, nor snow must be allowed to delay the arrival of the truck, at the scene of action, when accident, sabotage or enemy bomb takes its toll.

That is why Marmon-Herrington *All-Wheel-Drive* converted Ford trucks are so widely specified by the military, and by informed civilian officials, for this service. They get through, where conventional drive trucks fail, and being the speediest, most maneuverable all wheel drive trucks on the market, *they get through fast.*

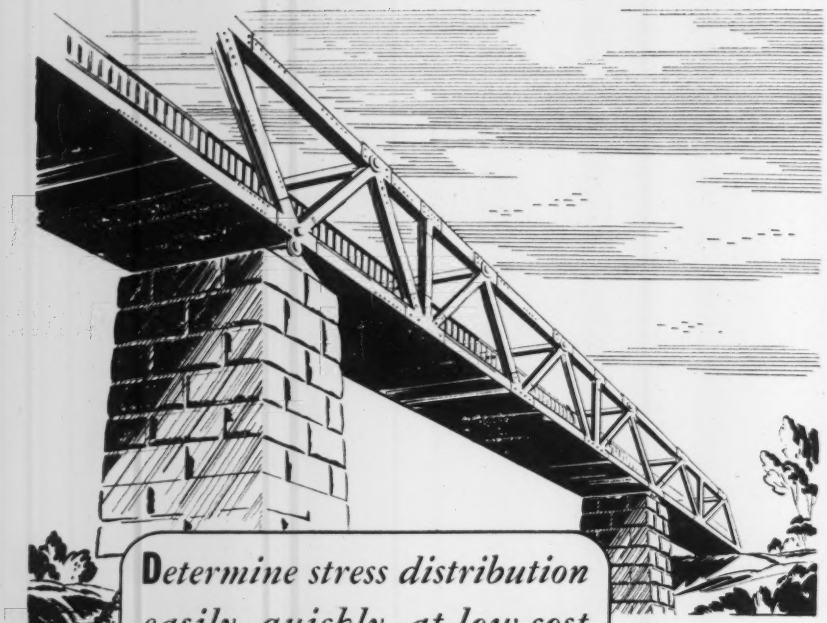
Users of these vehicles, in the oil fields, in road building and maintenance, in public utility services, logging camps, mining and general construction, etc., will find still greater advantages in Marmon-Herrington trucks when the war is won. Let your bond purchases help speed that day!

MARMON-HERRINGTON

All-Wheel-Drive

MARMON-HERRINGTON CO., Inc., INDIANAPOLIS, INDIANA

Cable Address: MARTON



Determine stress distribution easily, quickly, at low cost

SR-4

STRAIN GAGE

Now, for the first time, it is easy to measure strain resulting from changes in the loads on bridges and other structures as each member is put in place. By placing SR-4 Strain Gages, the simplest and most accurate instruments ever built to measure stresses, at a number of points on each member, it is possible to record every change that takes place in load distribution of a structure under construction.

Smaller than a postage stamp, SR-4 Strain Gages weigh only 1/84th of an ounce. They can be cemented in position wherever one can reach. Once installed, readings may be taken over extended periods of time. SR-4 Strain Gages, when connected to Baldwin Southwark indicating instruments, will record changes that occur down to one part in two million (15 lb. per sq. in. in steel). Frequencies handled range from zero to more than 30,000 cycles per second—without distortion.

Many standard types of SR-4 are available. Write for your copy of the new SR-4 Strain Gage Application booklet No. 171.

BLW THE BALDWIN GROUP **BALDWIN SOUTHWARK**

Division **THE BALDWIN LOCOMOTIVE WORKS,** *Philadelphia, Pa.*

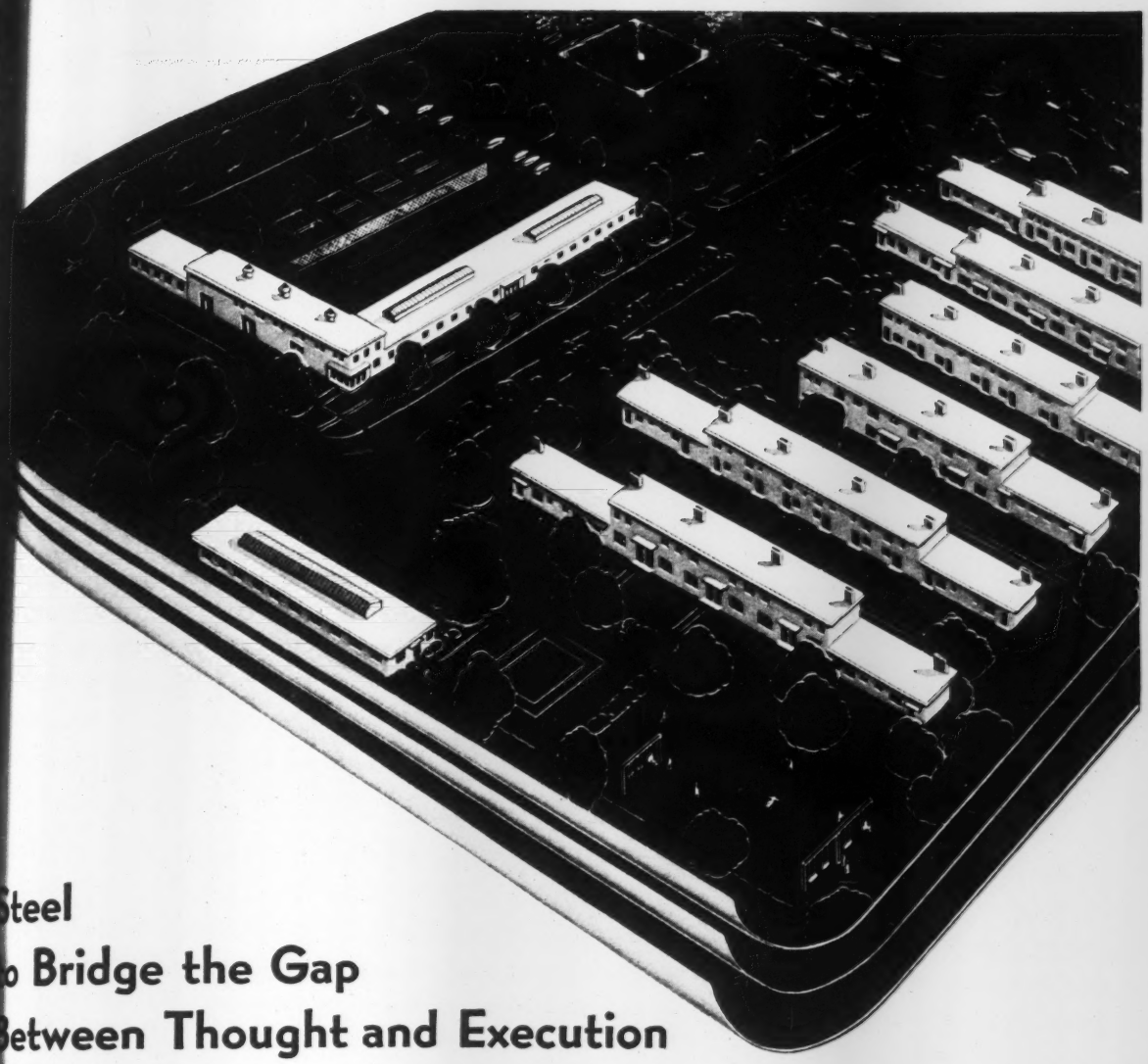
The Manhattan-Rubber Mfg. Div. of Raybestos-Manhattan, Inc., has acquired an option on a farm near Cl... N. J., for employees who have not sufficient land at home to make a V... garden. It is announced that if enough interest is shown in the plan, the company will lease the property for a year and pay the rental of the land, the expenses of plowing, harrowing, fertilizing. It will also furnish necessary tools. Employees will provide seed and till the gardens. According to present arrangements, the farm would be divided into units of about 20x40 ft., which is equal to a good-sized backyard garden. The farm is about a mile from the company's plant.

A THREE-WAY MEMORIAL salute to the five Sullivan brothers of Waterloo, Ia., who lost their lives in the sinking of the cruiser Juneau in action in the Solomons last November, was tendered on March 23 by workers of the Long Island City, N. Y., plant of the Irving Subway Grating Co., who turned out 130 emergency landing mat panels—equivalent to 1... sq.ft.—over their required quota for the day. These were earmarked for "Sullivan Field." The mats, a good portion of a runway, represent a full hour's output for each man, equivalent to $472.50 in wages. A check for the amount was sent as a contribution to the Waterloo sponsors of the Sullivan Memorial Fund.

WILLIAM LOREN BATT, vice chairman of the War Production Board and president of SKF Industries, Inc., Philadelphia manufacturers of ball and roller bearings, has been given the Bok Award—a medal and a $10,000 check—not only for his service to the nation in leading industrial mobilization of the war, but as the citizen who performed the most distinguished service for Philadelphia in 1942. This award is the twenty-first since its inception by the late Edward W. Bok in 1921.

JOHN A. RUHLING, formerly associated with the Milwaukee district office, has been appointed assistant manager of the Cement Products Bureau. For nine years Mr. Ruhling was fieldman for the Northeast Wisconsin district. He spent a considerable time in promotion of highway, sewage plants, storm and sanitary sewer, manufacturing and industrial plants and housing projects.

MERRILL N. DAVIS, executive vice president of the Dresser Mfg. Co., Bradford, Pa., died on March 7. In August, 19... Mr. Davis became associated with the company, in charge of sales and advertising. In December, 1928, he was elected a director.



teel
o Bridge the Gap
etween Thought and Execution

UT of Stran-Steel's wartime research and developments, eel will emerge as a new medium of expression—flexible s the mind of man, and adaptable to all his concepts. It ill take shape tomorrow in fresh and varied forms of rchitecture, where time-worn limitations are overcome achieve new scope and efficiency in building.

o less important than the developments which Stran-teel has already made is the vast fund of technical nowledge that is being acquired. Stran-Steel's broad ngineering background will serve the construction indus-y well in days to come.

STRAN STEEL

DIVISION OF GREAT LAKES STEEL CORPORATION
1130 PENOBSCOT BUILDING, DETROIT, MICHIGAN

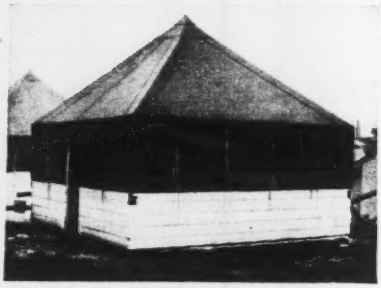
UNIT OF NATIONAL STEEL CORPORATION

BETTER LIVING CONDITIONS AND ECONOMY, TOO, WITH THE *Victory* TENT ADAPTER

Living conditions and morale of troops housed in pyramidal tents is well served when those tents are converted into weathertight housing with the Victory Tent Adapter Unit. The side walls and Air-Insulated, double roof of the Adapter are imposed on the present side walls of such tents.

Assured comfort in all weather through the ventilated, air-conditioned roof that means greater warmth in winter and protection against heat in summer; better lighting conditions that make writing, reading and other activities easier; positive insect control—all these are attained with the Victory Adapter Unit.

The Adapter means economy—savings over the cost of replacing worn-out canvas, savings in fuel bills and operating costs. And the Victory Adapter Unit can be installed by a crew of six men in one hour—or less—per tent.



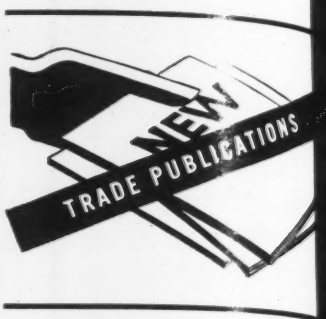
Pyramidal tents for which the "Victory" Adapter is designed

Officers in charge of tent camps or those concerned with housing personnel will find our well illustrated booklet "Victory Huts and Homes" helpful. It contains a chapter on the Victory Adapter Unit.

TEXAS PRE-FABRICATED HOUSE AND TENT CO.

Dallas, Texas

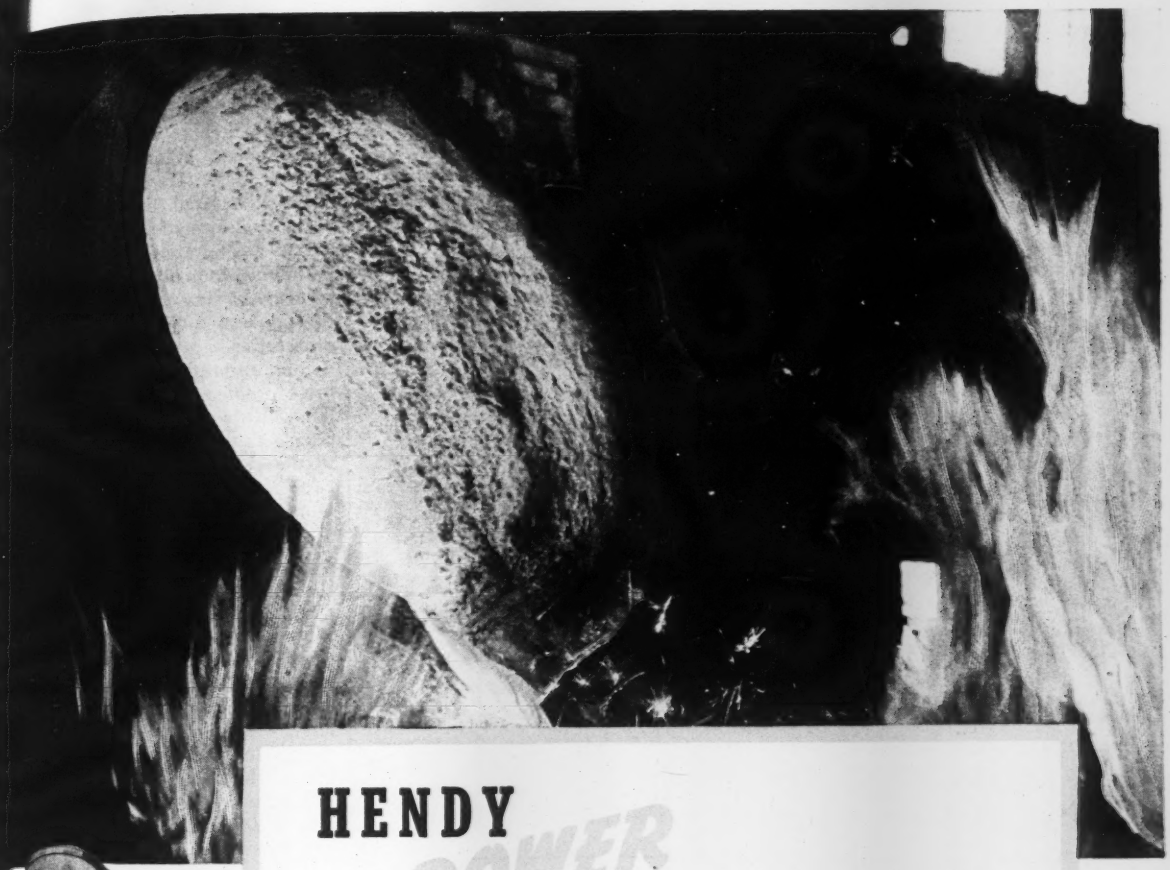
MAKERS OF "VICTORY" HUTS AND "VICTORY" HOMES



Industrial Fenestration — A cat... will shortly be issued showing an ada... tion of wood in a unique design for ... dow frame and bar construction w... aluminum and steel was previously ... The catalog will be of special value ... because of currently restricted us... metals. More information on reque... *E. K. Geyser & Co.*, 200 *Cedarhurst ... Pittsburgh, Pa.*

Motor Controls—How to select ... apply motor control is explained ... new 16-page General Electric ma... entitled "Simplified Guide to the S... tion and Application of Commonly U... Motor Controls." The fundamentals ... control are presented in an interes... manner with many illustrations and ... planatory diagrams. Starting with a ... ple analysis of the functions of con... the booklet next describes the basic ... trol parts of industrial devices. Follow... this is a discussion of the selection of ... rect control, explaining how to ch... between manual or magnetic, or w... reduced voltage starting is necess... The balance of the manual is devoted ... a progressive breakdown of stand... controls available, describing their ... eration and function, and to a desc... tion of enclosures for industrial con... devices. Free copies are available on ... quest. Write to—*General Electric ... Schenectady, N. Y.*

Plywood Data—The growing int... in plywood, now especially important ... cause of its many war uses, is evident ... by the large number of requests for ... recently published "Technique of P... wood," now in its third printing. T... 250-page technical treatise was wri... by Charles B. Norris and published ... I. F. Laucks, Inc., Seattle, Wash. ... Norris was formerly chief engineer ... the Lauxite Corp. of Lockport, N. ... before taking the position of princ... engineer in the division of timber ... chanics at the U. S. Forest Prod... Laboratory for the duration. His book ... written from a technical standpoint, ... marily for engineers, designers and us... of plywood, and covers all phases of ... wood manufacture. Copies obtain... from—*I. F. Laucks, Inc., 911 West ... Seattle, Wash.*



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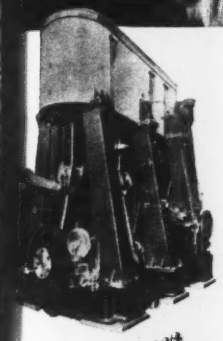
for the Bridge-of-Ships

Spanning the oceans between production and fighting fronts are mighty flotillas of Liberty Ships . . . the floating bridges for men and munitions...now mass produced on a scale formerly believed impossible.

More than one-third of these vessels are powered with dependable Hendy steam engines . . . the same type of Hendy power plants that carried Yanks to France in 1918. Today, however, the Iron Men of Hendy turn out as many engines in 11 days as they built in two years of World War I.

If Joshua Hendy could see what has been accomplished since 1856 . . . how the Hendy nameplate has become the distinguishing mark of dependable POWER . . . if he could look over the shoulders of Hendy engineers and see their plans for the future . . . he would take justifiable pride in his vision that POWER wins wars and insures peace.



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HENDY . . .

. . . now, for the first time in history, build marine steam engines by mass production, assembly line methods These engines stand two-and-one-half stories high and weigh 274,000 pounds.

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BETTER LIVING CONDITIONS AND ECONOMY, TOO, WITH THE *Victory* TENT ADAPTER

Living conditions and morale of troops housed in pyramidal tents is well served when those tents are converted into weathertight housing with the Victory Tent Adapter Unit. The side walls and Air-Insulated, double roof of the Adapter are imposed on the present side walls of such tents.

Assured comfort in all weather through the ventilated, air-conditioned roof that means greater warmth in winter and protection against heat in summer; better lighting conditions that make writing, reading and other activities easier; positive insect control—all these are attained with the Victory Adapter Unit.

The Adapter means economy—savings over the cost of replacing worn-out canvas, savings in fuel bills and op-

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MAKERS OF "VICTORY" HUTS AN
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because of currently restricted use
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Motor Controls— How to select
apply motor control is explained
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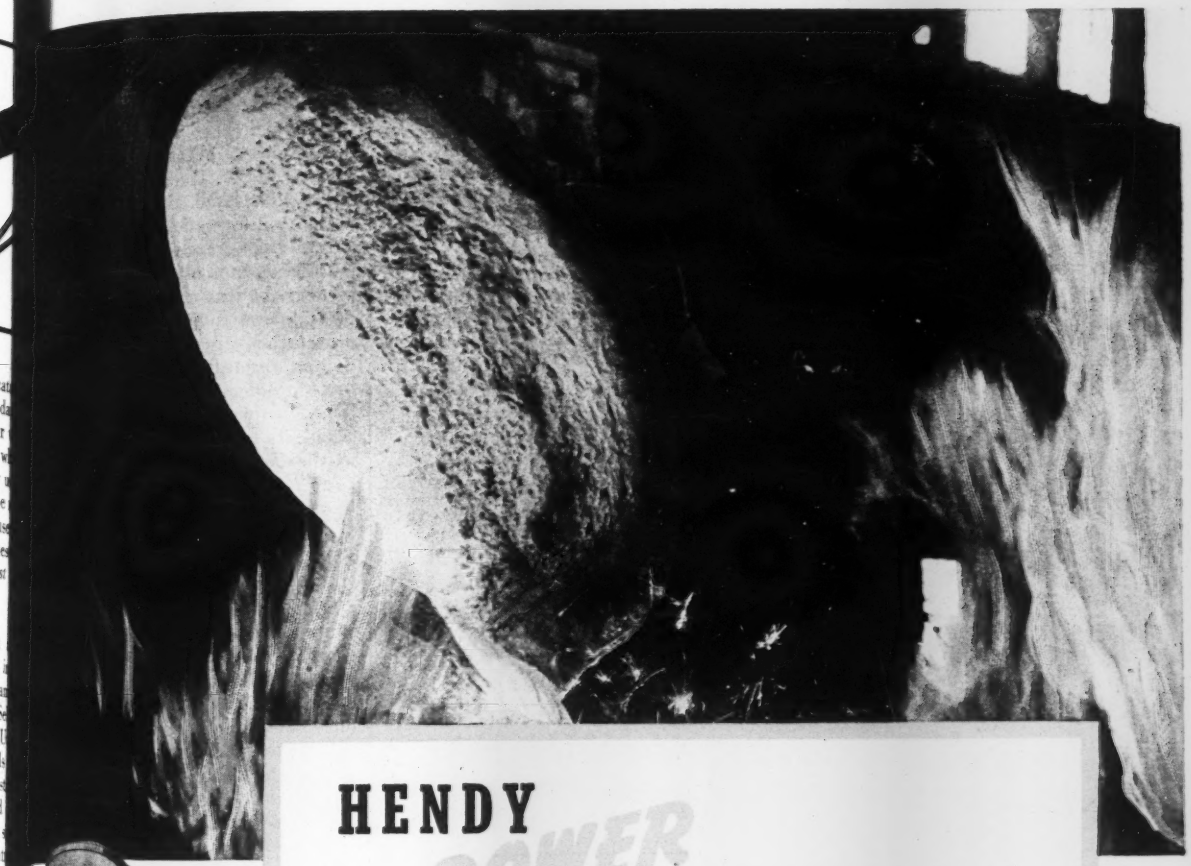

HENDY POWER
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via

Pomona Pump Company

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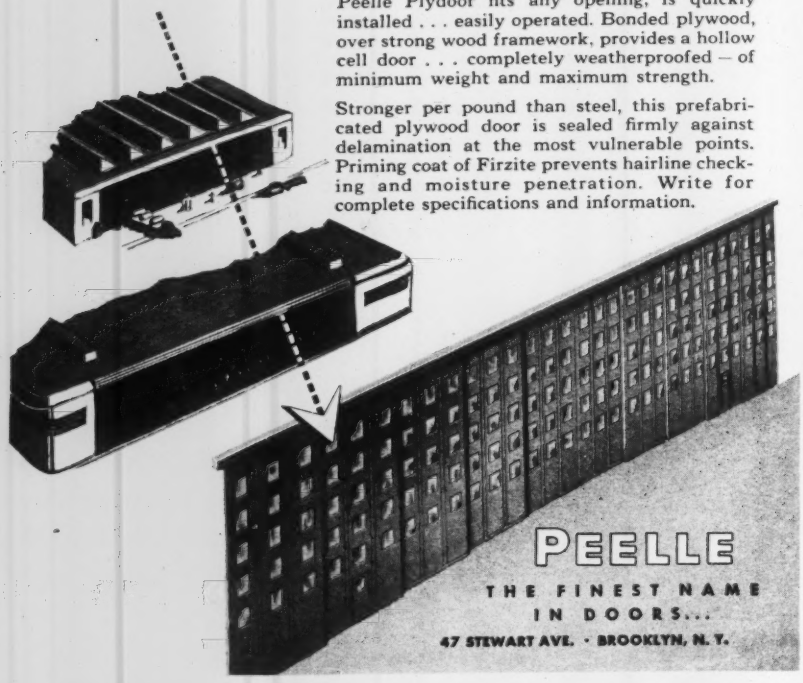
You supply the doorway

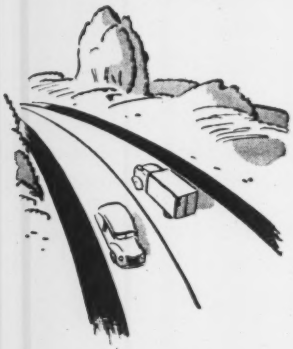
PEELLE HAS THE DOOR

Built to meet today's urgent demand, the NEW Peelle Plydoor fits any opening, is quickly installed . . . easily operated. Bonded plywood, over strong wood framework, provides a hollow cell door . . . completely weatherproofed — of minimum weight and maximum strength.

Stronger per pound than steel, this prefabricated plywood door is sealed firmly against delamination at the most vulnerable points. Priming coat of Firzite prevents hairline checking and moisture penetration. Write for complete specifications and information.



ASPHALT
for
HIGHWAY WIDENING AND MAINTENANCE



As an emergency measure, highway widening can provide adequate capacity for handling traffic flow increased by defense activity. This saves the delay and expense of constructing new roads which may or may not be required in normal times.

Asphalt construction offers the fastest and simplest method of getting results. Not only can it use local agregates, but Asphalt can be laid with little interference to traffic.

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STANDARD OIL COMPANY (Indiana)
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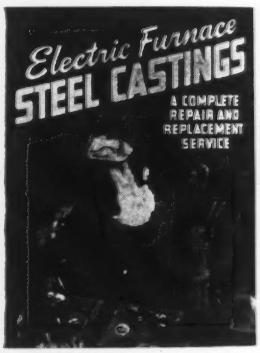
Booklet on Water—A forty-eight booklet of articles on scale, corrosion water treatment problems—reprints the most interesting and popular discussions which have appeared in the company's house organ, has just been issued by D. W. Haering & Co., Inc. Profusely illustrated, the book provides important information, including tables, charts and graphs on water problems pertaining to cooling systems, hot water systems, boilers and return systems. It special data on corrosion inhibitors, preventives, protective coatings, conditioning equipment and refrigerant brine problems. This booklet may be obtained without expense by chemists or engineers who will address their request to the company on their letterhead.—*D. W. Haering & Co., Inc., 205 W. Wacker Drive, Chicago, Ill.*

Reproduction Papers and Cloth—How to preserve, restore and duplicate original drawings is explained in a new eight-page illustrated booklet describing Keuffel & Esser's Photact Process. Photact reproduction papers and cloths produce duplicate tracings with ink lines, even from pencil originals; they serve even as "masters" and take the brunt of handling and blueprinting, while the original is filed safely away.—*Photact Dept., Keuffel & Esser Co., 127 and Adams St., Hoboken, N. J.*

Electric Drilling Rigs—Electric drilling rigs to meet any drilling problem are described and illustrated with photographs, charts and diagrams in a new 52-page booklet.—*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.*



Electric Steel Castings—A 40-page bulletin describes in detail the manufacture and application of electric furnace steel castings, carbon-steel castings, alloy steel castings, iron castings, non-ferrous castings, and the machining, heat-treating, and tempering of such castings, with numerous pictures to illustrate every operation. This bulletin also includes valuable general data on castings. Ask for Bulletin 801.—*The Eimco Corpn., Salt Lake City, Utah.*

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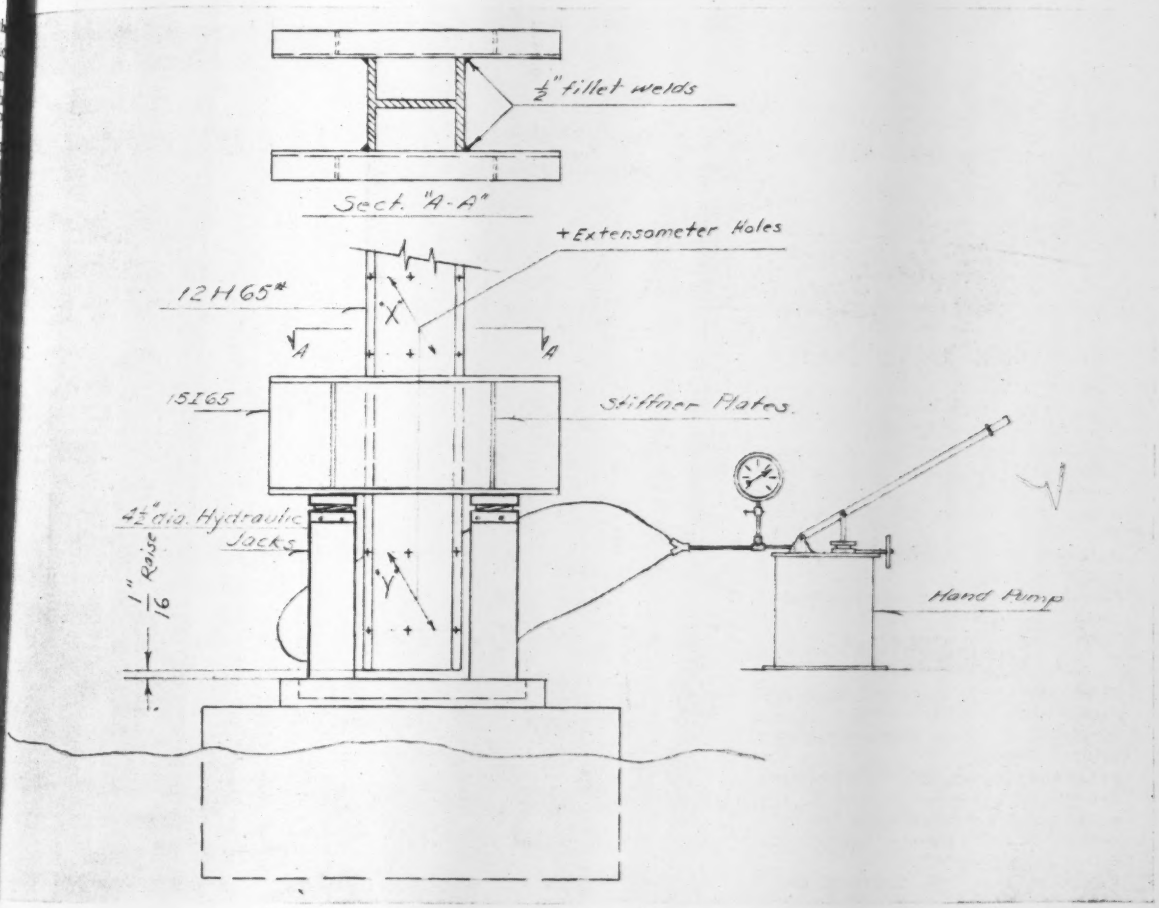
...of a column load!

Accurate measurements of column loads are required in underpinning or structural alterations. Spencer, White and Prentis developed a method (illustrated below) of determining the true load by extensometer readings taken before and after the column is lifted from its base. Lifting the column relieves section "Y" of its original load. It adds load to section "X". The extensometer readings record both loads and the sum is checked by the dial reading of the hydraulic jacks.

Blueprints made from *Typhonite* ELDORADO drawings are noted for accuracy. In the Typhonite process, graphite is battered against graphite in a typhoon of super-heated steam resulting in minute particles of controlled size. A 2H *Typhonite* ELDORADO is every inch a 2H largely because Typhonite particles are the same even controlled minute size! It is this exacting uniformity that has made *Typhonite* ELDORADO the pencil preferred by men behind America's drawing boards!



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STRONGER—Close-grained metal used; grain structure intensified by bolt-making processes and heat treatment.

TOUGHER—Cold-reduction of shank toughens skin surface for threading.

CLEANER—Threads *cold-worked;* strong, accurate, clean for quick assembly.

QUICKER—Point chamfered (60°) for ease in assembly.

*Up to ⅞" x 8"; larger sizes manufactured by another method.

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TOUGHER—Processed to guard against stripped threads.

CLEANER—Tapping is done with frequently-changed taps.

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*Regular nuts are processed cold through ⅞".

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CIVILIAN PROJECTS AUTOMATI... FALL INTO POST WAR RESE...

POST WAR PROJECTS

WATERWORKS

★ **Calif., San Francisco**—City, City E... projects modernizing San Francis... distr. sys., incl. new filtration plant... voirs and pipe replacements, etc. ... Dpt. $17,891,000.

★ **Calif., San Francisco**—City, P... Dpt., City Hall, Hetch-Hetchy ... ply and power project embracing dev... Lake-Eleanor-Cherry River Sect... with power house, power houses at ... ressy Dam, Early Intake and Red ... Barr, new pipeline across San Joaqu... addtl. power transmission line from ... to Newark, power line from Newark ... Francisco, $48,155,543.

★ **Mich., Detroit**—Dpt. Water Supp... Randolph St., Northeast booster ... and reservoir, 8 Mile-Connor-outle... Grand Trunk R. R. Part 2, $520,00... watermains, Meyers Rd., Fenkell to 8 M... $628,000; 54 in.-48 in. Belton, Evergre... ton, Meyers to Evergreen, Midland ... $2,730,000; meter shop and testing equ... Central Yard, $55,000; 54 in. main ... Livernois to Meyers Rd., $300,000; 48 in. ... Meyers to Greenfield Rd., $350,000; 36 in. ... 8 Mile, Greenfield to Telegraph Rd., Tele... Rd., 8 Mile to Bennett, $693,000; 24 in. ... 4th St., Fort to Cheny Sts., $75,000; ... main, Conant, Dwyer to McNichol... $550,000; replacing 4 in. pipe and elim... dead ends, $200,000; main relocations ... alterations at grade separations, $150,00... electrical switchgear, waterworks ... plant, $100,000; traveling screens, water... plant, $25,000; ash handling system, ... works plant, $50,000; coal handling sys. ... works plant, $160,000; flocculators, water... plant, $50,000; replacement pumps, 4, 5... waterworks plant, $450,000; 54, 48, 36 ... in. watermains 8 Mile Rd., John R. to Je... Ave., $2,550,000; pump. sta. boiler plant ... house, coal storage bldg., waterworks ... $2,000,000; pump discharge header, water... plant, $250,000; 54-48 in. main, Schaefe... Blesser to Michigan to Oakwood Ave., ... 000; 16 in. watermain 8 Mile Rd., Five ... to Telegraph Rds., $31,000; replacement ... steel pipe with c.i. pipe, Oakwood Blvd. ... Arlington, Main and Davison Ave., $2... 24 and 16 in. mains, Southfield, School ... 8 Mile Rd., $237,000.

Neb., Tecumseh—City, W. J. Dever... clk., rebuilding WW sys. $15,000. Hen... son Eng. Co., Standard Oil Bldg., Om... engrs.

★ **S. D., Aberdeen**—City, Lydia K... aud., imprvs., extens. water and sew... sys. $884,675.

Utah, Orem (Via Pleasant Grove)—To... Orem, c/o Town Clerk, Provo, Utah. ... concrete reservoir. H. Price, Provo, ... engr. CD 1/5/42—ENR 1/8/42.

Utah, Tooele—City, c/o J. D. Gol... mgr., storage reservoir for enlarging ... supply. CD 4/24/42—ENR 4/30/42.

Ont., Windsor—City, various com... have been set up to study different phas... proposed construction, incl. WW, ... municipal work, county work, (roads, ... etc.) and riverfront problems, etc.

★ **Que., Montreal**—Municipality, constru... new intake at foot of Lachine Ra... $2,000,000.

★ ★ ★ ★ ★

You can't spell VICTORY with "T" an absent T

JOHN F. NOON
Hyatt Roller Bearing
Precision Grinding Dept.

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Ia., Iowa City—City, V. J. Bureau, engr., trunk line sewer, storm and sanitary imprvs., extens., imprv. garbage disposal and city dump. $65,000.

Ia., Waterloo—City, H. H. Sipp, storm sewer to serve [illegible] man Addns. $138,000. A. H. Cook, engr.

★**Mich., Detroit**—Dpt. Wks., City addnl. incinerator plants, McNichols and 7 Mile Rd. Relief sewer parts, $2,000,000; relief sewers, $1,250,000; storm laterals, $600,000; riverfront sewer, $1,000,000; Fox Creek interceptor, $1,100,000; Conner sewage pump. sta. $245,000; Fox Creek outfall, $2,096,000; River Rouge Basin interceptor, $79,000; Bluehill sewage pumping sta. $138,000; Baby Creek [illegible] River Rouge interceptor, $490,000; Carbon outfall sewer, $1,939,000.

Mich., Escanaba—City, E. Benz, mgr., municipal incinerator plant.

★**N. Y., Brooklyn**—Dpt. Pub. Wks., Municipal Bldg., New York, Owls Head sewage treatment works. $14,600,000.

★**N. Y., New York**—Dpt. Pub. Wks., Municipal Bldg., Hunts Point sewage treatment works, Bronx Boro. $13,970,000.

S. D., Brookings—City, H. Dwiggins, sewage disposal plant addns., addnl. water and watermains, addnl. water tank. $60,000.

Ont., Whitby—Town, installing sewers, watermains, sidewalks, renovating municipal bldgs. and park imprvs. J. R. Frost, clk.

BRIDGES, GRADE CROSSING ELIMINATION

★**Mich., Detroit**—Dpt. Pub. Wks., City Hall, 14 street separations, $8,000,000; 66 railroad separations, $45,500,000; [illegible] underpass, $326,000.

New York—Dpt. Parks, Arsenal Bldg., Central Park, 5 Ave. and 64 St., New York, bridge over Fresh Meadow Rd., Kissena Park, Queens Boro. $25,000. Walter Hardesty, 101 Park Ave., New York, engr.

★**Tex., Houston**—City, bridges, paving, general imprvs. $700,000.

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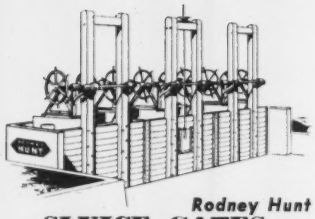

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